

CURRICULUM VITAE

Russell J. Hemley

Date and Place of Birth: October 26, 1954; Berkeley, California

Address: College of Liberal Arts and Sciences
University of Illinois Chicago
845 West Taylor Street, M/C 273, 211
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Education: Ph.D., Harvard University, Chemistry, 1983
M.A., Harvard University, Chemistry, 1980
B.A., Wesleyan University, Chemistry, 1977

Professional Experience:

2019- Liberal Arts and Sciences Distinguished Chair in the Natural Sciences, Professor of Physics and Chemistry, with appointment in Department of Earth and Environmental Sciences, University of Illinois Chicago

2016-2019 Research Professor, Institute of Materials Science and Department of Civil and Environmental Engineering, The George Washington University

2017 Mary Upson Visiting Professor, Department of Applied and Engineering Physics, Cornell University

2016-2018 Visiting Scientist, Geophysical Laboratory, Carnegie Institution

2016-2017 Physicist, Lawrence Livermore National Laboratory

2015-2017 Visiting Senior Scientist, Department of Chemistry, Georgetown University

2014-2018 Director, Energy Frontier Research in Extreme Environments (EFree), a DOE Energy Frontier Research Center

2014-2019 Chair, JASON Advisory Group

2009-2019 Co-Executive Director, Deep Carbon Observatory

2009-2014 Associate Director, Energy Frontier Research in Extreme Environments (EFree), a DOE Energy Frontier Research Center

2007-2013 Director, Geophysical Laboratory, Carnegie Institution

2003- Director, Carnegie/DOE Alliance Center (CDAC), a DOE/NNSA Center of Excellence; now Chicago/DOE Alliance Center

2003- Member, JASON Advisory Group

1987-2016 Senior Staff Scientist, Geophysical Laboratory

1996-1999 Visiting Professor, Ecole Normale Supérieure, Lyon, France

1991 Visiting Professor, Johns Hopkins University

1984-1987 Carnegie Fellow, Geophysical Laboratory, Carnegie Institution

1983-1984 Postdoctoral Fellow, Harvard University

1979-1983 Teaching Fellow/Research Assistant, Harvard University
1977-1978 Teaching Fellow/Research Assistant, Wesleyan University

Selected Honors and Awards:

Sack Lecturer, Cornell University, 2017
Mineral hemleyite named by Italian scientists and approved by the International Mineralogical Association, 2016
Marker Lecturer, Pennsylvania State University, 2016
Pimentel Lecturer, University of California – Berkeley, 2014
Bridgman Award, International Association for the Advancement of High Pressure Science and Technology, 2009
Honoris Causa Professor for Energetics, Mechanics, Machinery, and Control Systems, Russian Academy of Sciences, 2008
Corresponding Fellow, Royal Society of Edinburgh, 2008
Balzan Prize in Mineral Physics, 2005
Hillebrand Medal, American Chemical Society, 2003
Member, National Academy of Sciences, 2001
Fellow, American Academy of Arts and Sciences, 1997
Fellow, American Geophysical Union, 1997
Fellow, American Physical Society, 1996
Alan Berman Research Pub. Award, Dept. of the Navy, 1996
Fellow, Mineralogical Society of America, 1990
Mineralogical Society of America Award, 1990
Phi Beta Kappa, 1977
Sigma Xi, 1977

Research Interests:

High-pressure behavior of materials, particularly Earth and planetary materials; transformations of hydrogen at multimegabar pressures; novel high-pressure compound formation and pressure-induced chemical reactions in molecular systems; synthesis and characterization of new superhard materials, superconductors, and magnetic materials; pressure-induced amorphization; the effects of pressure on amorphous solids; the rational design of new high-pressure materials from first-principles methods; models for Earth and planetary interiors; fabrication of single crystal diamond by chemical vapor deposition; development of high-pressure methods and analytical techniques such as micro-optical spectroscopy, synchrotron infrared spectroscopy, synchrotron x-ray diffraction and spectroscopy, laser heating, magnetic susceptibility, electrical conductivity, and high-pressure cryogenic methods; science issues related to national security.

Professional Service:

NRC Workshop on Physics and Chemistry of Earth Materials, Airlie, Virginia, 1986
Contributor, *Earth Materials Research*, edited by C. T. Prewitt et al., National Academy Press, Washington, D.C., 1987
Participant, Mineral Physics Workshop, American Geophysical Union Mineral Physics Committee Workshop, Lake Arrowhead, California, September 1988

Convenor, High-Pressure Mineral Physics, 1988 Goldschmidt Conference, Hunt Valley, Maryland
 Contributor, *Synchrotron X-ray Sources and New Opportunities in the Earth Sciences: Workshop Report*, J. Smith and M. Manghnani, co-chairs, Argonne National Lab., Argonne, IL, 1988
 Contributor, *Frontiers in Mineral Physics*, Report of the AGU Mineral Physics Committee, AGU, Washington, D.C. 1989, edited by T. J. Ahrens et al.
 Program Committee, 12th AIRAPT Meeting, Paderborn, West Germany, July 1989
 Member, GeoSynch Committee, American Geophysical Union, 1989-
 Committee on Committees, Mineralogical Society of America, 1990
 Committee for Study of the Earth's Interior (SEI), American Geophysical Union, 1990-
 Associate Editor, *Journal of Geophysical Research*, 1991-1993
 Contributor, *Science at the Frontier*, edited by A. Greenwood et al., National Academy Press, Washington, D.C. 1992
 Co-Convenor, Symposium on Computational Physics in Mineralogy, 29th International Geological Congress, Kyoto, 1992
 Session Organizer, Symposium on Cooperative Studies of the Earth's Deep Interior (CSEDI), Santa Fe, New Mexico, October 1993
 Co-convenor, Thermoelasticity of Perovskite: Toward an Emerging Consensus, Special Session, Fall Meeting of the American Geophysical Union, San Francisco, California, 1993
 Member, Program Committee, Joint AIRAPT/APS Meeting, Colorado Springs, Colorado, June 1993
 Leader, Diamond-Anvil Cell Design Team, Geo/Soil/EnviroCARS (Consortium for Advanced Radiation Sources), University of Chicago and Advanced Photon Source, Argonne National Laboratory, 1993-
 Co-convenor, Symposium on the Earth's Lower Mantle and Core, International Mineralogical Association Meeting, Pisa, Italy, September 1994
 Co-convenor, Materials at High Pressure, Focused Session of the Division of Materials Physics, American Physical Society, March Meeting, Pittsburgh, Pennsylvania, 1994
 Visiting Committee, CHESS High-Pressure Facility, Cornell University, September 1994
 Editorial Board, *High-Pressure Research*, November 1994-
 Chairman, GeoSynch Committee, American Geophysical Union, December 1995-1997
 Member, Board of Governors, Consortium for Advanced Radiation Sources, Argonne, Illinois, 1996-1997
 Co-chairman, Mineral Physics Committee, International Mineralogical Association, 1996-1998
 Member, Mineral and Rock Physics Committee, American Geophysical Union, 1996-1998
 Member, Roebling Medal Committee, Mineralogical Society of America, 1996-
 Member, Steering Committee, Center for High-Pressure Research, 1996-
 Spokesperson of U2A PRT of the NSLS, 1996-
 Co-convenor, Symposium on Materials at High Pressure, Materials Research Society, Boston, November 1997
 Member, Geophysical Laboratory Director Search Committee, 1997
 Member, Bridgman Award Committee, AIRAPT, 1997-
 Co-covenor, Mineralogical Society of America Short Course, "Ultrahigh-Pressure Mineralogy", Davis, California, December 1998
 Chairman, Mineral Physics Committee, International Mineralogical Association, 1998-
 Member, High Pressure International Commission, Union of Crystallography, 1998-
 Co-convenor, CIW-MSA-NSF Workshop "Mineralogy at the Millennium", April 1999

Member, Program Committee, 17th AIRAPT Conference, 1999
Co-convenor, CECAM Workshop: Frontiers in High-Pressure Materials Physics, July 1999
Participant, NSF/NRC Workshop on Mineral and Rock Physics, May 1999
Member, High-Pressure Commission, International Union of Crystallography, 1999-
Member, Steering Committee, HPCAT, Advanced Photon Source, 1999-
Visiting Committee, Institute for the Study of the Earth's Deep Interior, Misasa, Japan, January
2000
Co-convenor, High-Pressure Neutron Scattering Workshop, Argonne National Lab, April 2000
Co-convenor, Laser-Heating Workshop, Advanced Photon Source, May 2000
Co-convenor, W. A. Bassett Symposium, AGU Spring Meeting, May 2000
Member, Program Committee, Warm Dense Matter Workshop, Vancouver, Canada, May 2000
Member, Program Committee, International Cryocrystals and Quantum Crystals Conference,
Szkarska Poreba, Poland, July 2000
Co-convenor, IGC Mineral Physics and Chemistry Symposium, Rio de Janeiro, Brazil, Aug. 2000
Member, Program Committee, IUCr High-Pressure Workshop, SPRing8, Japan, Oct. 2000
Co-convenor, In Situ Techniques Symposium, Goldschmidt Conf., Roanoke, VA, May 2000
Advisory Editor, High-Pressure Research, 2000-
Director, Enrico Fermi School of Physics "High-Pressure Phenomena", Varenna, Italy, July 2001
Member, Program Committee, IUCr Workshop on Neutron and X-ray Diffraction, Saclay, France,
October 2001
Member, Executive Committee, NSF COMPRES Consortium, 2002-2004
Co-PI, High-Pressure Beamline of the Spallation Neutron Source, Oak Ridge National Laboratory,
2002-
Member, Visiting Committee, Dept. of Earth and Planetary Sciences, Harvard University, 2003
Director, Carnegie/DOE Alliance Center (CDAC), 2003-
Member, Mineralogical Society of America Award Committee, 2004 -
Member, Program Committee, International Cryocrystals and Quantum Crystal Conference,
Wroclaw, Poland, September 2004
Co-convenor, Roebling Symposium, Geological Society of America, 2005
Member, Visiting Committee, Dept. of Earth and Planetary Sciences, Harvard University, 2006
Member, Program Committee, IMA, Kobe, 2006
Member, Program Committee, ADC Conference, 2006
Co-convenor, Workshop on Synergy of 21st Century High-Pressure Science and Technology,
Advanced Photon Source, Argonne, IL, 2006
Member, Selection Committee for the American Physical Society Shock Compression Science
Award, 2006
Member, Visiting Committee, Department of Earth & Planetary Sciences, Harvard University,
2006
Member, Program Committee, Synergy of 21st Century High-Pressure Science & Technology
Workshop, APS, 2006
Member, Project Advisory Committee, NSLS-II, 2006-2009
Co-convenor, High-Pressure Materials Science Symposium, MRS, Boston, 2007
Member, Program Committee, International Cryocrystals and Quantum Crystals Conference,
Wroclaw, Poland, 2007 -
Co-chair, DOE-BES Basic Research Needs Workshop: Materials in Extreme Environments, 2007
Chair, Board of Governors, HPSynC, Argonne National Lab, 2007-

Member, Board on Earth Science and Resources, National Research Council, 2007–
Member, Advisory Board of Fizika Nizkikh Temperatur, 2008
Member, Review Committee, National Academy of Sciences, NCNR, NIST, 2008-2011
Member, Physical Sciences Directorate Review Committee, LLNL, 2008
Member, MaRIE External Advisory Committee, LANL, 2008-2014
Member, Advisory Committee, CC-2010 Conference on Cryocrystals and Quantum Crystals, 2009
Panel Lead, Future of Compression Science Workshop, LANL, 2009
Member, COMPRES Laser Heating Workshop Program Committee 2009
Member, Stanley Miller Medal Selection Committee, NAS, 2009
Member, LANS/LLNS Mission Committee, 2009-2015
Review Coordinator, NAS Comprehensive Test Ban Treaty Study, 2010
Vice-Chair, Energy Frontiers in Extreme Environments Center Steering Committee, DOE-BES
EFRC, 2010-2014
Co-chair, Deep Carbon Observatory Executive Committee, A. P. Sloan Foundation/Carnegie
Institution, 2010-2019
Member, CC2010 Program Committee, Chernogolovka, 2010
Member, Shock Compression in Condensed Matter Program Committee, APS, 2010-
Member, CHESS ERL Advisory Committee, Cornell University, 2010-2012
Member, Light Sources Directorate Science Advisory Committee, Brookhaven National
Laboratory, 2010-2013
Panel Leader, National Ignition Facility User Science Workshop Committee, 2011
Member, Technical Committee, 2013 Joint APS/AIRAPT Conference, 2012-2013
Member, NSLS-II Beamtime Review Panel, Brookhaven National Laboratory, 2014-2017
Member, NIF & PS Directorate Review Committee, Lawrence Livermore National
Laboratory, 2014-
Member, Program Committee, Novel Phases of Silicon Conference, 2015
Member, Advisory Board, 11th International Conference on Cryocrystals, and Quantum Crystals
(CC2016), 2015
Member, DOE BESAC Subcommittee on Major Facilities, 2016
Panel Lead, NSF Workshop on Midscale Instrumentation for Quantum Materials, 2017
Member, DOE Review Committee of LCLS, 2018
Member, Radiation Effects and High Energy Density Science External Review Board, Sandia
National Laboratories, 2018-2021
Panel Member, NSF Workshop on Basic Plasma Science User Facilities, 2019
Member, Second Target Station Instrument Review Committee (STS-IRC), Spallation Neutron
Source, Oak Ridge National Laboratory, 2021-
Member, National Academy Review Committee on High Energy Density Science, 2021-

Thesis Advisors:

V. Vaida, M. Karplus

Postgraduate Sponsors:

M. Karplus, R. G. Gordon, H. K. Mao, and P. M. Bell

Supervised Postdoctoral Fellows, Research Associates, and Research Scientists (92):

M. Ahart (Aihaiti), J. V. Badding, J. Badro, A. Basu, V. S. Bhadram, J. Blank, P. Beck, A. J. Campbell, R. Chellappa, A. Chen, J. Chen, X. J. Chen, J. Ciezak, D. A. Dalton, P. Dera, O. Degtyareva, Y. Ding, T. S. Duffy, J. H. Eggert, M. I. Eremets, M. Furlanetto, Z. Geballe, A. F. Goncharov, S. A. Gramsch, E. Gregoryanz, Q. Guo, M. Hanfland, H. Hellwig, K. Hemawan, J. Z. Hu, D. Hummer, S. D. Jacobsen, A. P. Jephcoat, J. Jackson, J. Janik, P. E. Janolin, T. Jenkins, J. D. Kubicki, R. Kumar, A. Lazicki, P. Lazor, J. Li, M. Li, J. Lin, H. Liu, Z. Liu, R. Lu, Y. Ma, K. Matsuishi, I. I. Mazin, R. S. McWilliams, C. Meade, Y. Meng, Y. F. Meng, A. Mishra, J. Montoya, C. Murphy, T. Muramatsu, S. Nakano, S. Natarajan, I. Naumov, T. Okuchi, D. C. Palmer, R. J. Potter, J. Rodgers, N. Salke, C. Seagle, C. Sanloup, M. Santoro, C. Schiffries, H. P. Scott, T. Schindelbeck, A. Sharma, G. Shen, J. Shu, M. Somayazulu, Y. Song, S. Stewart, L. Stixrude, T. Strobel, V. V. Struzhkin, N. Subramanian, R. Thugoluva, Yu. A. Timofeev, S. Tkachev, O. Tschauner, W. L. Vos, M. Weinberger, Y. Wu, J. Xu, C. S. Yan, S. Yang, Y. Yoshimura, C. S. Zha, G. Zou

Supervised Ph.D. Students (22):

Y. Chen, P. G. Conrad, A. Denchfield, P. Griffin, S. S. Ho, K. J. Kingma, J. D. Kubicki, J. Lai, A. Lamichhane, W. L. Mao, A. H. M. Marathamkottil, A. Mark, S. Merkel, M. Origlieri, J. R. Patterson, R. Ripani, A. Shen, S. Shieh, D. M. Teter, E. Vinitsky, T. Zapata, C. Zoller

Supervised Undergraduate and High School Students (62):

L. Armstrong, E. Banigan, C. Barkett, A. Benjamin, K. Brownsberger, B. Chidester, K. Chen, P. N. Chen, C. Chin, D. Cohen, J. Cohen, A. Davis, C. Farnsworth, K. Gan, R. Graham, B. Haugen, K. Hernandez, T. Hittinger, A. Levedahl, Z. Liang, A. Lindoo, E. Littlefield, S. Jacobsen, M. James, Y. Kadry, S. Khattar, S. King, M. Krawczynski, R. Kundargi, A. Kung, S. Kung, T. Liu, W. Liu, L. Loubeyre, A. Madduri, M. Madduri, T. McHale, R. Mershon, J. Mesa, M. Moses, Z. Newman, K. Phillips, D. Platner, F. Reid, O. Reyes-Becerra, J. Rivera, L. Rosario, M. Rose, V. Rozsa, C. Runge, E. Sandford, A. Savello, A. Schad, S. Scott, B. Shih, D. Shook, G. Sutton, I. Tambllyn, C. Tarabrella, R. Thomas, N. Valdez, C. Vallerio, B. Wilfong, M. Wong, A. Young

Patents (18)

Edited Books:

1. *High-Pressure Materials Research. Materials Research Society Symposium, Vol. 499*, edited by R. M. Wentzcovitch, R. J. Hemley, W. J. Nellis and P. Y. Yu, Materials Research Society, Warrendale, Pennsylvania, 1998, 476 p.
2. *Ultrahigh-Pressure Mineralogy, Reviews in Mineralogy, Vol. 37*, edited by R. J. Hemley, Mineralogical Society of America, Washington, D.C., 1998, 671 p.
3. *Physics Meets Mineralogy - Condensed Matter Physics in Geosciences*, edited by H. Aoki, Y. Syono, and R. J. Hemley, Cambridge University Press, Cambridge, England, 2000, 396 p.
4. *High-Pressure Phenomena, Proceedings of the International School of Physics*, edited by R. J. Hemley, M. Bernasconi, L. Ulivi, and G. Chiarotti, IOS Press, Amsterdam, 2002.

5. *Materials Research at High Pressure, Symposium Proceedings, Vol. 987*, edited by M. R. Manaa, A. F. Goncharov, R. J. Hemley, and R. Bini, Materials Research Society, Warrendale, Pennsylvania, 2007.

Scientific Articles:

1977

1. Hemley, R. J. and B. E. Kohler, Electronic structure of the visual chromophore: A mathematical model for the observed bandshapes, *Biophys. J.*, **20**, 377-382 (1977).

1979

2. Hemley, R., B. E. Kohler, and P. Siviski, Absorption spectra for the complexes formed from vitamin A and β -lactoglobulin, *Biophys. J.*, **28**, 447-455 (1979).

1980

3. Roebber, J. L., D. P. Gerrity, R. J. Hemley, and V. Vaida, Electronic spectrum of furan from 2200 to 1950 Å, *Chem. Phys. Lett.*, **75**, 104-106 (1980).

1981

4. Hemley, R. J., D. G. Leopold, J. L. Roebber, and V. Vaida, Electronic absorption spectra of jet-cooled molecules: the S₂ state of styrene, *J. Phys. Chem.*, **85**, 134-135 (1981).
5. Leopold, D. G., R. J. Hemley, J. L. Roebber, and V. Vaida, Direct absorption spectra of higher excited states of jet-cooled monosubstituted benzenes: phenylacetylene, styrene, benzaldehyde, and acetophenone, *J. Chem. Phys.*, **75**, 4758-4759 (1981).
6. Vaida, V., N. J. Cooper, R. J. Hemley, and D. G. Leopold, Production of gas-phase bare transition-metal clusters by laser photodissociation of organometallic cluster compounds, *J. Am. Chem. Soc.*, **103**, 7022-7023 (1981).

1983

7. Dinur, U., R. J. Hemley, and M. Karplus, Equilibrium geometry and dynamics of the valence excited states of 1,3-butadiene, *J. Phys. Chem.*, **87**, 924-932 (1983).
8. Hemley, R. J., J. I. Dawson, and V. Vaida, Franck-Condon analysis of the $1^1A_g \rightarrow 1^1B_u$ transition of 1,3-butadiene from absorption and Raman intensities, *J. Chem. Phys.*, **78**, 2915-2927 (1983).
9. Hemley, R. J., D. G. Leopold, J. L. Roebber, and V. Vaida, The direct absorption spectrum of the $1^1\Sigma_g^+ \rightarrow 1^1B_{2u}(\Sigma_u^+)$ transition of jet-cooled CS₂, *J. Chem. Phys.*, **79**, 5219-5227 (1983).

1984

10. Kohler, B. E., T. Spiglanin, R. J. Hemley, and M. Karplus, Vibrational analysis of the lowest $1^1B_u^+$ state of trans, trans 1,3,5,7-octatetraene, *J. Chem. Phys.*, **80**, 23-30 (1984).

11. Leopold, D. G., R. D. Pendley, J. L. Roebber, R. J. Hemley, and V. Vaida, Direct absorption spectroscopy of jet-cooled polyenes. II. The $1^1A_g \rightarrow 1^1B_u$ transitions of butadiene and hexatriene, *J. Chem. Phys.*, **81**, 4218-4229 (1984).

1985

12. Hemley, R. J., U. Dinur, V. Vaida, and M. Karplus, Theoretical study of the ground and excited singlet states of styrene, *J. Am. Chem. Soc.*, **107**, 836-844 (1985).
13. Hemley, R. J. and R. G. Gordon, Theoretical study of solid NaF and NaCl at high pressures and temperatures, *J. Geophys. Res.*, **90**, 7803-7813 (1985).
14. Hemley, R. J., M. D. Jackson, and R. G. Gordon, First-principles theory for the equations of state of minerals to high pressures and temperatures: application to MgO, *Geophys. Res. Lett.*, **12**, 247-250 (1985).
15. Hemley, R. J., G. Leopold, V. Vaida, and M. Karplus, The singlet states of styrene. Theoretical vibrational analysis of the ultraviolet spectrum, *J. Chem. Phys.*, **82**, 5379-5397 (1985).
16. Mao, H. K., P. M. Bell, and R. J. Hemley, Ultrahigh pressures: optical observations and Raman measurements of hydrogen and deuterium to 1.47 Mbar, *Phys. Rev. Lett.*, **55**, 99-102 (1985).

1986

17. Bell, P. M., H. K. Mao, and R. J. Hemley, Observations of solid H₂, D₂, N₂ at pressures around 1.5 megabar at 25°C, *Physica B*, **139-140**, 16-20 (1986).
18. Hemley, R. J., B. R. Brooks, and M. Karplus, Theoretical study of the ground-state vibrations of the linear polyenes, *J. Chem. Phys.*, **85**, 6550-6564 (1986).
19. Hemley, R. J., H. K. Mao, P. M. Bell, and B. O. Mysen, Raman spectroscopy of SiO₂ glass at high pressure, *Phys. Rev. Lett.* **57**, 747-750 (1986).
20. Hemley, R. J., H. K. Mao, and E. C. T. Chao, Raman spectrum of natural and synthetic stishovite, *Phys. Chem. Minerals*, **13**, 285-290 (1986).
21. Hemley, R. M., H. K. Mao, P. M. Bell, and S. Akimoto, Lattice vibrations of high-pressure SiO₂ phases: Raman spectrum of synthetic stishovite, *Physica B*, **139-140**, 455-457 (1986).
22. Mehl, M. J., R. J. Hemley, and L. L. Boyer, Potential-induced breathing model for the elastic moduli and high-pressure behavior of the cubic alkaline-earth oxides., *Phys. Rev. B*, **33**, 8685-8696 (1986).

1987

23. Hazen, R. M., H. K. Mao, L. W. Finger, and R. J. Hemley, Single-crystal x-ray diffraction of n-H₂ at high pressure, *Phys. Rev. B*, **36**, 3944-3947 (1987).
24. Hemley, R. J., Pressure dependence of Raman spectra of SiO₂ polymorphs: α -quartz, coesite, and stishovite, in *High-Pressure Research in Mineral Physics* (eds. M. H. Manghnani and Syono, Y.), 347-359 (Terra Scientific Publishing Company, Tokyo/American Geophysical Union, Washington, D. C., 1987).
25. Hemley, R. J., P. M. Bell, and H. K. Mao, Laser techniques in high-pressure geophysics, *Science*, **237**, 605-612 (1987).

26. Hemley, R. J., M. D. Jackson, and R. G. Gordon, Theoretical study of the structure, lattice dynamics, and equations of state of perovskite-type MgSiO₃ and CaSiO₃, *Phys. Chem. Minerals*, **14**, 2-12 (1987).
27. Hemley, R. J., A. P. Jephcoat, H. K. Mao, C. S. Zha, L. W. Finger, and D. E. Cox, Static compression of H₂O-ice to 128 GPa (1.28 Mbar), *Nature*, **330**, 737-740 (1987).
28. Hemley, R. J. and H. K. Mao, Single-crystal micro-Raman spectroscopy of phases in the Y-Ba-Cu-O superconductor, *Phys. Rev. Lett.*, **58**, 2340-2342 (1987).
29. Jephcoat, A. P., H. K. Mao, L. W. Finger, D. E. Cox, R. J. Hemley, and C. S. Zha, Pressure-induced structural phase transitions in solid xenon, *Phys. Rev. Lett.*, **59**, 2670-2673 (1987).
30. Mao, H. K., R. J. Hemley, and E. C. T. Chao, The application of micro-Raman spectroscopy to analysis and identification of minerals in thin section, *Scanning Microscopy*, **1**, 495-501 (1987).

1988

31. Hemley, R. J., High-pressure studies of planetary gases and liquids, *Eos Trans. Am. Geophys. Union*, **69**, 159-160 (1988).
32. Hemley, R. J., A. P. Jephcoat, H. K. Mao, L. C. Ming, and M. H. Manghnani, Pressure-induced amorphization of crystalline silica, *Nature*, **334**, 52-54 (1988).
33. Hemley, R. J., A. C. Lasaga, V. Vaida, and M. Karplus, Theoretical analysis of the $1^1B_u^+(^1B_1^+) \rightarrow 1^1A_g^-(^1A_1^-)$ transition of *trans* and *cis* 1,3,5-hexatriene, *J. Phys. Chem.*, **92**, 945-954 (1988).
34. Hemley, R. J. and H. K. Mao, Phase transition in solid molecular hydrogen at ultrahigh pressures, *Phys. Rev. Lett.*, **61**, 857-860 (1988).
35. Hemley, R. J., P. F. McMillan, and G. H. Wolf, Optical spectroscopic techniques, in *Frontiers in Mineral Physics, Report of the Mineral Physics Committee of the American Geophysical Union, Chapter 13, Lake Arrowhead, CA* (eds. W. A. Bassett, Mackwell, S. J. and McMillan, P. F.), 51-99 (American Geophysical Union, 1988).
36. Hemley, R. J. and R. F. Porter, Raman spectroscopy at ultrahigh pressures, *Scripta Metallurgica*, **22**, 139-144 (1988).
37. Jephcoat, A. P., R. J. Hemley, and H. K. Mao, X-ray diffraction of Cr⁺³:Al₂O₃ to 175 GPa, *Physica B*, **150**, 115-121 (1988).
38. Jephcoat, A. P., R. J. Hemley, H. K. Mao, R. E. Cohen, and M. J. Mehl, Raman spectroscopy and theoretical modelling of BeO at high pressure, *Phys. Rev. B*, **37**, 4727-4734 (1988).
39. Kubicki, J. D. and R. J. Hemley, *In-situ* high-pressure Raman spectra of silicate glasses, *Ann. Report Director Geophys. Lab. 1987-1988*, (1988).
40. Mao, H. K., R. J. Hemley, Y. Wu, A. P. Jephcoat, L. W. Finger, C. S. Zha, and W. A. Bassett, High-pressure phase diagram and equation of state of solid helium from single-crystal x-ray diffraction to 23.3 GPa, *Phys. Rev. Lett.*, **60**, 2649-2652 (1988).
41. Mao, H. K., A. P. Jephcoat, R. J. Hemley, L. W. Finger, C. S. Zha, R. M. Hazen, and D. E. Cox, Synchrotron x-ray diffraction measurements of single-crystal hydrogen to 26.5 GPa, *Science*, **239**, 1131-1134 (1988).
42. Stevenson, D. J., R. J. Hemley, and E. Knittle, Metallization of non-conductors, in *Frontiers in Mineral Physics, Report of the Mineral Physics Committee of the American Geophysical Union, Chapter 22, Lake Arrowhead, CA* (eds. W. A. Bassett, Mackwell, S. J. and McMillan, P. F.), 97-99 (American Geophysical Union, Washington, D.C., 1988).

1989

43. Chen, L. C., H. K. Mao, and R. J. Hemley, Compression and polymorphism of CaSiO_3 at high pressures and temperatures, *Ann. Report Director Geophys. Lab.*, **1988-1989**, 94-98 (1989).
44. Finger, L. W., R. M. Hazen, and R. J. Hemley, $\text{BaCuSi}_2\text{O}_6$: A new cyclosilicate with four-membered tetrahedral rings, *Am. Mineral.*, **74**, 952-955 (1989).
45. Finger, L. W., J. Ko, R. M. Hazen, T. Gasparik, R. J. Hemley, C. T. Prewitt, and D. J. Weidner, Crystal chemistry of phase B and an anhydrous analogue: implications for water storage in the upper mantle, *Nature*, **341**, 140-142 (1989).
46. Hazen, R. M., L. W. Finger, R. J. Hemley, and H. K. Mao, High-pressure crystal chemistry and amorphization of α -quartz, *Solid State Comm.*, **72**, 507-511 (1989).
47. Hemley, R. J., L. C. Chen, and H. K. Mao, New transformations between crystalline and amorphous ice, *Nature*, **338**, 638-640 (1989).
48. Hemley, R. J., R. E. Cohen, A. Yeganeh-Haeri, H. K. Mao, D. J. Weidner, and E. Ito, Raman spectroscopy and lattice dynamics of MgSiO_3 perovskite at high pressure, in *Perovskite: A Structure of Great Interest to Geophysics and Materials Science* (eds. A. Navrotsky and Weidner, D. J.), 35-53 (American Geophysical Union, Washington, D. C., 1989).
49. Hemley, R. J., A. P. Jephcoat, C. S. Zha, H. K. Mao, L. W. Finger, and D. E. Cox, Equation of state of solid neon from x-ray diffraction measurements to 110 GPa, in *High Pressure Science and Technology, Proceedings of the XIth AIRAPT Conference* (eds. N. V. Novikov and Chistyakov, Y. M.), **Vol. 3**, 211-217 (Naukova Dumka, Kiev, 1989).
50. Hemley, R. J. and H. K. Mao, Isotope effects in dense solid hydrogen: phase transition in deuterium at 190 ± 20 GPa, *Phys. Rev. Lett.*, **63**, 1393-1395 (1989).
51. Hemley, R. J. and H. K. Mao, New optical transitions in type Ia diamonds at very high stresses, *Ann. Report Director Geophys. Lab.*, **1988-1989**, 105-108 (1989).
52. Hemley, R. J., C. S. Zha, A. P. Jephcoat, H. K. Mao, L. W. Finger, and D. E. Cox, X-ray diffraction and equation of state of solid neon to 110 GPa, *Phys. Rev. B*, **39**, 11820-11827 (1989).
53. Kubicki, J. D. and R. J. Hemley, Spectroscopic evidence for a new high-pressure magnesium silicate phase, *Ann. Report Director Geophys. Lab.*, **1988-1989**, 91-94 (1989).
54. Mao, H. K., L. C. Chen, R. J. Hemley, A. P. Jephcoat, Y. Wu, and W. A. Bassett, Stability and equation of state of CaSiO_3 perovskite to 134 GPa, *J. Geophys. Res.*, **94**, **B12**, 17889-17894 (1989).
55. Mao, H. K., J. Hemley, J. F. Shu, L. C. Chen, A. P. Jephcoat, Y. Wu, and W. A. Bassett, The effect of pressure, temperature, and composition on the lattice parameters and density of $(\text{Fe,Mg})\text{SiO}_3$ -perovskites to 30 GPa, in *Annual Report of the Director of the Geophysical Laboratory, Carnegie Instn. Washington, 1988-1989* (Geophysical Laboratory, Washington, D. C., 1989).
56. Mao, H. K. and R. J. Hemley, Optical observations of hydrogen above 200 gigapascals: evidence for metallization by band overlap, *Science*, **244**, 1462-1465 (1989).
57. Mao, H. K., Y. Wu, R. J. Hemley, L. C. Chen, J. F. Shu, and L. W. Finger, X-ray diffraction to 302 gigapascals: high-pressure crystal structure of cesium iodide, *Science*, **246**, 649-651 (1989).

1990

58. Mao, H. K., Y. Wu, R. J. Hemley, L. C. Chen, J. F. Shu, L. W. Finger, and D. E. Cox, High-pressure phase transition and equation of state of CsI, *Phys. Rev. Lett.*, **64**, 1749-1752 (1990).
59. Mao, H. K., Y. Wu, J. F. Shu, J. Z. Hu, R. J. Hemley, and D. E. Cox, High-pressure phase transition and equation of state of lead to 238 GPa, *Solid State Comm.*, **74**, 1027-1029 (1990).
60. Mao, H. K., and R. J. Hemley, Response to Technical Comment by I. F. Silvera, *Science*, **247**, 863-864 (1990).
61. Hemley, R. J. and H. K. Mao, Structural transitions in hydrogen and deuterium at ultrahigh pressures, International AIRAPT Conference, XIIth, Paderborn, West Germany, *High Pressure Res.*, **5**, 156-158 (1990).
62. Mao, H. K., Y. Wu, L. C. Chen, J. F. Shu and R. J. Hemley, Pressure calibration to 304 GPa on the basis of X-ray diffraction measures of Pt, Fe and CSI, International AIRAPT Conference, XIIth, Paderborn, West Germany, July 18-21, 1989, *High Pressure Res.*, **5**, 773-775 (1990).
63. Hemley, R. J., and H. K. Mao, Critical behavior in the hydrogen insulator-metal transition, *Science*, **249**, 391-393 (1990).
64. Mao, H. K., R. J. Hemley, and M. Hanfland, Infrared reflectance measurements of the insulator-metal transition in solid hydrogen, *Phys. Rev. Lett.*, **65**, 484-487 (1990).
65. Hemley, R. J., H. K. Mao, L. W. Finger, A. P. Jephcoat, R. M. Hazen, and C. S. Zha, Equation of state of solid hydrogen and deuterium from single-crystal x-ray diffraction to 26.5 GPa, *Phys. Rev. B*, **42**, 6458-6470 (1990).
66. Hemley, R. J., H. K. Mao, and J. F. Shu, Low-frequency vibrational dynamics and structure of hydrogen at megabar pressures, *Phys. Rev. Lett.*, **65**, 2670-2673 (1990).
67. Hanfland, M., R. J. Hemley and H. K. Mao, Optical properties of hydrogen at megabar pressures, *Ann. Report Director Geophys. Lab.*, 1989-1990, 96-100 (1990).

1991

68. Badding, J. V., R. J. Hemley, and H. K. Mao, High-pressure chemistry of hydrogen in metals: *in-situ* study of iron hydride, *Science*, **253**, 421-424 (1991).
69. Badding, J. V., H. K. Mao, and R. J. Hemley, High-pressure synchrotron x-ray diffraction of Cs IV and Cs V, *Solid State Comm.*, **77**, 801-805 (1991).
70. Fei, Y., H. K. Mao, R. J. Hemley, and J. Shu, Simultaneous high P-T diffraction measurements of (Fe,Mg)SiO₃-perovskite and (Fe,Mg)O magnesiowüstite: implications for lower mantle composition, *Ann. Rep. Geophys. Lab.*, 107-114 (1991).
71. Hanfland, M., R. J. Hemley, and H. K. Mao, Optical absorption measurements of hydrogen at megabar pressures, *Phys. Rev. B*, **43**, 8767-8770 (1991).
72. Hemley, R. J., M. Hanfland, and H. K. Mao, High-pressure dielectric measurements of hydrogen to 170 GPa, *Nature*, **350**, 488-491 (1991).
73. Hemley, R. J. and J. D. Kubicki, Deep mantle melting, *Nature*, **349**, 283-284 (1991).
74. Hemley, R. J., H. K. Mao, and M. Hanfland, Spectroscopic investigations of the insulator-metal transition in solid hydrogen, in *Molecular Solids Under Pressure* (eds. R. Pucci and Piccitto, G.), 223-243 (Elsevier, Amsterdam, 1991).
75. Kaxiras, E., J. Broughton, and R. J. Hemley, Onset of metallization and related transitions in solid hydrogen, *Phys. Rev. Lett.*, **67**, 1138-1141 (1991).
76. Mao, H. K. and R. J. Hemley, New optical transitions in diamond at ultrahigh pressures, *Nature*, **351**, 721-724 (1991).

77. Mao, H. K., R. J. Hemley, Y. Fei, J. F. Shu, L. C. Chen, A. P. Jephcoat, Y. Wu, and W. A. Bassett, Effect of pressure, temperature, and composition on lattice parameters and density of (Fe,Mg)SiO₃-perovskites to 30 GPa, *J. Geophys. Res.*, **96**, **B5**, 8069-8079 (1991).
78. Vos, W. L., L. W. Finger, R. J. Hemley, H. K. Mao, J. Hu, J. Shu, R. LeSar, A. deKuijper, and J. A. Schouten, X-ray diffraction of solid nitrogen-helium mixtures, *Ann. Rep.. Geophys. Lab.*, 138-141 (1991).

1992

79. Badding, J. V., H. K. Mao, and R. J. Hemley, High-pressure crystal structure and equation of state of iron hydride: Implications for the Earth's core, in *High Pressure Research in Mineral Physics: Application to Earth and Planetary Sciences*, Y. Syono and M. Manghnani, eds., pp. 363-371, Terra Scientific Publishing Company, Tokyo/American Geophysical Union, Washington, D.C. (1992).
80. Eggert, J. H., C. S. Zha, R. J. Hemley, and H. K. Mao, Raman scattering of vibrational overtones in deuterium at high pressures, *J. Low Temp. Phys.*, **89**, 707-710 (1992).
81. Hanfland, M., R. J. Hemley, H. K. Mao, and G. P. Williams, Synchrotron infrared spectroscopy at megabar pressures: vibrational dynamics of hydrogen to 180 GPa, *Phys. Rev. Lett.*, **69**, 1129-1132 (1992).
82. Hemley, R. J. and R. E. Cohen, Silicate perovskite, *Ann. Rev. Earth Planet. Sci.*, **20**, 553-600 (1992).
83. Hemley, R. J. and H. K. Mao, Anomalous low-frequency excitations in diamond-cell studies of hydrogen at megabar pressures, *Phys. Lett. A*, **163**, 429-434 (1992).
84. Hemley, R. J. and H. K. Mao, Static compression to multimegabar pressures, in *Proceedings of the APS 1991 Topical Conference on Shock Compression of Condensed Matter, June 17-20, 1991, Elsevier, New York* (eds. S. C. Schmidt, Dick, R. D., Forbes, J. W. and Tasker, D. G.), (Williamsburgh, VA, 1992).
85. Hemley, R. J. and H. K. Mao, Metallic hydrogen, in *McGraw-Hill Yearbook of Science and Technology* 207-209 (McGraw-Hill, New York, 1992).
86. Hemley, R. J. and H. K. Mao, ed. *Raman studies of dense hydrogen: constraints on structure, dynamics, and metallization*, ICORS Wurzburg '92 - Thirteenth International Conference on Raman Spectroscopy, (J. Wiley & Sons, New York, 1992).
87. Hemley, R. J., L. Stixrude, Y. Fei, and H. K. Mao, Constraints on the composition of the lower mantle from *P-V-T* measurements of (Fe,Mg)SiO₃-perovskite and (Fe,Mg)O, in *High-Pressure Research in Mineral Physics: Application to Earth and Planetary Sciences* (eds. Y. Syono and Manghnani, M.), (Terra Scientific Publishing Co, Washington, D. C., 1992).
88. Kubicki, J. D., R. J. Hemley, and A. M. Hofmeister, Raman and infrared study of pressure-induced structural changes in MgSiO₃, CaMgSi₂O₆, and CaSiO₃ glasses, *Am. Mineral.*, **77**, 258-269 (1992).
89. Mao, H. K. and R. J. Hemley, Hydrogen at high pressure, *Am. Sci.*, **80**, 234-247 (1992).
90. Mao, H. K., R. J. Hemley, and M. Hanfland, Stability of ruby in solid hydrogen at megabar pressures, *Phys. Rev. B*, **45**, 8108-8111 (1992).
91. Meade, C., R. J. Hemley, and H. K. Mao, High pressure x-ray diffraction of SiO₂ glass, *Phys. Rev. Lett.*, **69**, 1387-1390 (1992).
92. Meade, C., R. Jeanloz, and R. J. Hemley, Spectroscopic and x-ray diffraction studies of metastable crystal-amorphous transitions in Ca(OH)₂ and serpentine, in *High Pressure*

Research in Mineral Physics: Application to Earth and Planetary Sciences (eds. Y. Syono and Manghnani, M.), 485-492 (Terra Scientific Publishing Co, in press, 1992).

93. Stixrude, L., R. J. Hemley, Y. Fei, and H. K. Mao, Thermoelasticity of silicate perovskite and magnesiowüstite and stratification of the Earth's mantle, *Science, in press*, (1992).
94. Vos, W. L., L. W. Finger, R. J. Hemley, J.-Z. Hu, H. K. Mao, and J. A. Schouten, A high-pressure van der Waals compound in solid nitrogen-helium mixtures, *Nature*, **358**, 46-48 (1992).

1993

95. Eggert, J. H., H. K. Mao, and R. J. Hemley, Observation of two-vibron bound-to-unbound transition in solid deuterium at high pressure, *Phys. Rev. Lett.*, **70**, 2301-2304 (1993).
96. Fei, Y., H. K. Mao, and R. J. Hemley, Thermal expansivity, bulk modulus, and melting curve of H₂O-ice VII to 20 GPa, *J. Chem. Phys.*, **99**, 5369-5373 (1993).
97. Hanfland, M., R. J. Hemley, and H. K. Mao, Novel infrared vibron absorption in solid hydrogen at megabar pressures, *Phys. Rev. Lett.*, **70**, 3760-3763 (1993).
98. Hemley, R. J., J. H. Eggert, and H. K. Mao, Low-frequency Raman spectroscopy of deuterium to megabar pressure at 77-295 K, *Phys. Rev. B*, **48**, 5779-5788 (1993).
99. Hemley, R. J., H. K. Mao, M. Hanfland, J. H. Eggert, C. S. Zha, and J. F. Shu, Experimental investigations of dense solid hydrogen. In *Strongly Coupled Plasma Physics*, H. M. Van Horn and S. Ichimaru, eds., pp. 3-10, University of Rochester Press, Rochester, N.Y. (1993).
100. Kingma, K. J., R. J. Hemley, H. K. Mao, and D. R. Veblen, New high-pressure transformation in α -quartz, *Phys. Rev. Lett.*, **70**, 3927-3930 (1993).
101. Kingma, K. J., C. Meade, R. J. Hemley, H. K. Mao, and D. R. Veblen, Microstructural observations of α -quartz amorphization, *Science*, **259**, 666-669 (1993).
102. Loubeyre, P., R. Letoullec, J. P. Pinceaux, H. K. Mao, J. Hu, and R. J. Hemley, Equation of state and phase diagram of solid 4He from single-crystal x-ray diffraction over a large P-T domain, *Phys. Rev. Lett.*, **71**, 2272-2275 (1993).
103. Vos, W. L., L. W. Finger, R. J. Hemley, and H. K. Mao, Novel H₂-H₂O clathrates at high pressures, *Phys. Rev. Lett.*, **71**, 3150-3153 (1993).
104. Williams, Q., R. J. Hemley, M. Kruger, and R. Jeanloz, High pressure infrared spectra of α -quartz, coesite, stishovite, and silica glass, *J. Geophys. Res.*, **98**, 22157-22170 (1993).
105. Zha, C. S., T. S. Duffy, H. K. Mao, and R. J. Hemley, Elasticity of hydrogen to 24 GPa from single-crystal Brillouin scattering and synchrotron radiation, *Phys. Rev. B*, **48**, 9246-9255 (1993).

1994

106. Duffy, T. S., W. Vos, C. S. Zha, R. J. Hemley, and H. K. Mao, Sound velocity in dense hydrogen and the interior of Jupiter, *Science*, **263**, 1590-1593 (1994).
107. Eggert, J. H., R. J. Hemley, and H. K. Mao, Raman scattering evidence for a new phase transition in normal deuterium at high pressures, in *Proceedings of the Fourteenth International Conference on Raman Spectroscopy* (eds. N. Yu and Li, X.), 1008-1009 (John Wiley & Sons, New York, 1994).
108. Eggert, J. H., R. J. Hemley, H. K. Mao, and J. L. Feldman, Rotation-vibration and intermolecular dynamics of hydrogen and deuterium, in *High-Pressure Science and Technology - 1993* (eds. S. C. Schmidt, Shaner, J. W., Samara, G. A. and Ross, M.), 845-848 (American Institute of Physics, New York, 1994).

109. Eggert, J. H., H. K. Mao, and R. J. Hemley, Bivibron linewidths in solid deuterium at high pressure, *J. Luminesc.*, **58**, 328-331 (1994).
110. Hanfland, M., R. J. Hemley, and H. K. Mao, Synchrotron infrared measurements of pressure-induced transformations in solid hydrogen, in *High-Pressure Science and Technology - 1993* (eds. S. C. Schmidt, Shaner, J. W., Samara, G. A. and Ross, M.), 877-880 (American Institute of Physics, New York, 1994).
111. Hemley, R. J., C. T. Prewitt, and K. J. Kingma, High-pressure behavior of silica, in *Reviews of Mineralogy* (eds. P. Heaney, Gibbs, G. V. and Prewitt, C. T.), **29**, 41-81 (Mineralogical Society of America, Washington, D.C., 1994).
112. Hemley, R. J., Z. G. Soos, M. Hanfland, and H. K. Mao, Charge transfer states in dense hydrogen, *Nature*, **369**, 384-387 (1994).
113. Hu, J., H. K. Mao, J. Shu, and R. J. Hemley, High pressure energy dispersive x-ray diffraction technique with synchrotron radiation, in *High Pressure Science and Technology -- 1993* (eds. S. C. Schmidt, Shaner, J. W., Samara, G. A. and Ross, M.), **1**, 441-444 (AIP Press, New York, 1994).
114. Jeanloz, R. and R. J. Hemley, Thermoelasticity of perovskite: an emerging consensus, *Eos Trans. Am. Geophys. Union*, **75**, 476-477 (1994).
115. Kingma, K. J. and R. J. Hemley, Raman spectroscopic study of microcrystalline silica, *Am. Mineral.*, **79**, 269-273 (1994).
116. Kingma, K. J., R. J. Hemley, H. K. Mao, and D. R. Veblen, Reply to Comment by L. McNeil and M. Grimsditch on 'New high-pressure transformation in α -quartz', *Phys. Rev. Lett.*, **72**, 1302 (1994).
117. Kingma, K. J., R. J. Hemley, D. R. Veblen, and H. K. Mao, High-pressure crystalline transformations and amorphization in α -quartz, in *High-Pressure Science and Technology - 1993* (eds. S. C. Schmidt, Shaner, J. W., Samara, G. A. and Ross, M.), 39-42 (American Institute of Physics, New York, 1994).
118. Mao, H. K. and R. J. Hemley, Ultrahigh-pressure transitions in solid hydrogen, *Rev. Mod. Phys.*, **66**, 671-692 (1994).
119. Mao, H. K., R. J. Hemley, and A. L. Mao, Recent design of ultrahigh-pressure diamond cell, in *High Pressure Science and Technology --1993* (eds. S. C. Schmidt, Shaner, J. W., Samara, G. A. and Ross, M.), **2**, 1613-1616 (AIP Press, New York, 1994).
120. Mao, H. K., J. Shu, J. Hu, and R. J. Hemley, High-pressure x-ray diffraction study of diasporite, *Solid State Comm.*, **90**, 497-500 (1994).
121. Palmer, D. C., R. J. Hemley, and C. T. Prewitt, Raman spectroscopic study of high-pressure phase transitions in cristobalite, *Phys. Chem. Minerals*, **21**, 481-488 (1994).
122. Reffner, J., G. L. Carr, S. Sutton, R. J. Hemley, and G. P. Williams, Infrared microspectroscopy at the NSLS, *Synchrotron Radiation News (Technical Reports)*, **7**, 30-37 (1994).
123. Reichlin, R., A. K. McMahan, M. Ross, S. Martin, J. Hu, R. J. Hemley, H. K. Mao, and Y. Wu, Optical, x-ray, and band-structure studies of iodine at pressures of several megabars, *Phys. Rev. B*, **49**, 3725-3733 (1994).
124. Soos, Z. G., J. H. Eggert, R. J. Hemley, M. Hanfland, and H. K. Mao, Charge transfer and electron-vibron coupling in dense solid hydrogen, *Chem. Phys.*, **200**, 23-39 (1994).
125. Vos, W. L., L. W. Finger, R. J. Hemley, H. K. Mao, and H. S. Yoder, Phase behavior of H_2 - H_2O at high pressure, in *High Pressure Science and Technology --1993* (eds. S. C. Schmidt, Shaner, J. W., Samara, G. A. and Ross, M.), **1**, 857-860 (AIP Press, New York, 1994).

126. Zha, C. S., T. S. Duffy, H. K. Mao, and R. J. Hemley, ed. *High-pressure Brillouin scattering elastic constants of single-crystal hydrogen to 24 GPa*, High-Pressure Science and Technology - 1993, (American Institute of Physics, New York, 1994).
127. Zha, C. S., T. S. Duffy, H. K. Mao, and R. J. Hemley, Brillouin scattering of silica glass to 57.5 GPa, in *High-Pressure Science and Technology - 1993* (eds. S. C. Schmidt, Shaner, J. W., Samara, G. A. and Ross, M.), 93-96 (American Institute of Physics, New York, 1994).
128. Zha, C. S., R. J. Hemley, H. K. Mao, T. S. Duffy, and C. Meade, Acoustic velocities and refractive index of SiO₂ glass to 57.5 GPa by Brillouin scattering, *Phys. Rev. B*, **50**, 13105-13112 (1994).

1995

129. Duffy, T. S. and R. J. Hemley, Temperature structure of the Earth, *Rev. Geophys. (U. S. National Report to IUGG)*, 5-9 (1995).
130. Duffy, T. S., R. J. Hemley, and H.-k. Mao, Structure and bonding in hydrous minerals at high pressure: Raman spectroscopy of alkaline earth hydroxides, in *Volatiles in the Earth and Solar System* (ed. K. A. Farley), 211-220 (Am. Inst. Physics, New York, 1995).
131. Duffy, T. S., R. J. Hemley, and H. K. Mao, Equation of state and shear strength at multimegabar pressures: Magnesium oxide to 227 GPa, *Phys. Rev. Lett.*, **74**, 1371-1374 (1995).
132. Duffy, T. S., C. Meade, Y. Fei, H. K. Mao, and R. J. Hemley, High-pressure phase transition in brucite, Mg(OH)₂, *Am. Mineral.*, **80**, 222-230 (1995).
133. Duffy, T. S., J. Shu, H.-k. Mao, and R. J. Hemley, Single-crystal x-ray diffraction of brucite to 14 GPa, *Phys. Chem. Minerals*, **22**, 277-281 (1995).
134. Duffy, T. S., C. S. Zha, R. T. Downs, H. K. Mao, and R. J. Hemley, Elastic constants of forsterite Mg₂SiO₄ to 16 GPa, *Nature*, **378**, 170-173 (1995).
135. Feldman, J. L., J. H. Eggert, J. de Kinder, R. J. Hemley, H. K. Mao, and D. Shoemaker., Vibron excitations in solid hydrogen: a generalized binary random alloy problem, *Phys. Rev. Lett.*, **74**, 1379-1382 (1995).
136. Goncharov, A. F., I. I. Mazin, J. H. Eggert, R. J. Hemley, and H. K. Mao, Invariant points and phase transitions in deuterium at megabar pressures, *Phys. Rev. Lett.*, **75**, 2514-2517 (1995).
137. Hanfland, M., R. J. Hemley, and H. K. Mao, Reply to "Comment on 'Optical absorption measurements of hydrogen at megabar pressures' ", *Phys. Rev. B*, **52**, 1408-1410 (1995).
138. Hemley, R. J., Sound and fury in Jupiter, *Science*, **269**, 1233-1234 (1995).
139. Hemley, R. J., Turning off the water, *Nature*, **378**, 14-15 (1995).
140. Hemley, R. J. and H. K. Mao, Progress on hydrogen at ultrahigh pressures, in *Elementary Processes in Dense Plasmas* (eds. S. Ichimaru and Ogata, S.), 269-280 (Addison-Wesley, Reading, MA, 1995).
141. Hemley, R. J., H. K. Mao, T. S. Duffy, J. H. Eggert, A. F. Goncharov, M. Hanfland, M. Li, M. Somayazulu, W. Vos, and C. S. Zha, Dense hydrogen in the outer solar system: implications from recent high-pressure experiments, in *Volatiles in the Earth and Solar System* (ed. K. A. Farley), 250-260 (American Institute of Physics, New York, 1995).

142. Kingma, K. J., R. E. Cohen, R. J. Hemley, and H. K. Mao, Transformation of stishovite to a denser phase at lower mantle pressures, *Nature*, **374**, 243-245 (1995).
143. Mao, H. K., J. H. Eggert, and R. J. Hemley, Reflectance effects caused by refractive-index gradients in diamond-anvil cell samples of H₂ and Al₂O₃, *Mod. Phys. Lett. B*, **9**, 201-208 (1995).
144. Soos, Z. G., J. H. Eggert, R. J. Hemley, M. Hanfland, and H. K. Mao, Charge transfer and electron-vibron coupling in dense solid hydrogen, *Chem. Phys.*, **200**, 23-39 (1995).
145. Yoo, C. S., J. Akella, A. J. Campbell, H. K. Mao, and R. J. Hemley, Phase diagram of iron by in situ x-ray diffraction: implications for the Earth's core, *Science*, **270**, 1473-1475 (1995).

1996

146. McMillan, P. F., J. Dubessy and R. J. Hemley, Applications in Earth, planetary and environmental sciences, in *Raman Microscopy: Developments and Applications* (eds. G. Turrell and Corset, J.) 289-365 (Academic, New York, 1996).
147. Mao, H. K., and R. J. Hemley, Energy dispersive x-ray diffraction of micro-crystals at ultrahigh pressures, *High Pressure Res.*, **14**, 257-267 (1996).
148. Kingma, K. J., H. K. Mao, and R. J. Hemley, Synchrotron x-ray diffraction of SiO₂ to multimegabar pressures, *High Press. Res.*, **14**, 363-374 (1996).
149. Mao, H. K., J. F. Shu, Y. Fei, J. Hu, and R. J. Hemley, The wustite enigma, *Phys. Earth Planet. Inter.*, **96**, 135-145 (1996).
150. Bundy, F. P., W. A. Bassett, M. S. Weathers, R. J. Hemley, H. K. Mao, and A. F. Goncharov, The pressure-temperature phase and transformation diagram for carbon; updated through 1994, *Carbon*, **34**, 141-153 (1996).
151. McMillan, Paul F., P. Gillet, and R. J. Hemley, Vibrational spectroscopy of mantle minerals, in *Mineral Spectroscopy, A Tribute to Roger G. Burns*, (eds. M. D. Dyar, C. A. McCammon, and M. W. Schaefer) 175-213 (Geochemical Society, Houston, 1996).
152. Hemley, R. J., and R. E. Cohen, Structure and bonding in the deep mantle and core, *Proc. Roy. Soc. London A*, **354**, 1315-1332 (1996).
153. Mao, H. K., and R. J. Hemley, Experimental study of the Earth's deep interior: accuracy and versatility of diamond cells, *Proc. Roy. Soc. London A*, **354**, 1315-1332, (1996).
154. Teter, D. M., and R. J. Hemley, Low-compressibility carbon nitrides, *Science*, **271**, 53-55 (1996).
155. Goncharov, A. F., J. H. Eggert, I. I. Mazin, R. J. Hemley, and H. K. Mao, Raman excitations and orientational ordering in deuterium at high pressure, *Phys. Rev. B*, **54**, 15590-15593 (1996).
156. Hemley, R. J., and H. K. Mao, Dense molecular hydrogen: Order, disorder, and localization, *J. Non-Cryst. Solids*, **205/207**, 282-289 (1996).
157. Mao, H. K. and R. J. Hemley, Solid hydrogen at ultrahigh pressures, in *High Pressure Science and Technology* (ed. W. A. Trzeciakowski) 505-510 (World Scientific, Warsaw, Poland, 1996).
158. Goncharov, A. F., I. I. Mazin, J. H. Eggert, R. J. Hemley, and H. K. Mao, Orientational order, disorder, and possible glassy behavior in dense deuterium, in *High Pressure Science and Technology* (ed. W. A. Trzeciakowski) 505-510 (World Scientific, Warsaw, Poland, 1996).

159. Struzhkin, V. V., Yu. A. Timofeev, R. T. Downs, R. J. Hemley, and H. K. Mao, $T_C(P)$ from magnetic susceptibility measurements in high temperature superconductors: $YBa_2Cu_3O_{7-x}$ and $HgBa_2Ca_2Cu_3O_{8+x}$ in *High Pressure Science and Technology* (ed. W. A. Trzeciakowski) 505-510 (World Scientific, Warsaw, Poland, 1996).
160. Hemley, R. J., H. K. Mao, A. F. Goncharov, M. Hanfland, and V. V. Struzhkin, Synchrotron infrared spectroscopy to 0.15 eV of H_2 and D_2 at megabar pressures, *Phys. Rev. Lett.*, **76**, 1667-1670 (1996).
161. Vos, W. L., L. W. Finger, R. J. Hemley, and H. K. Mao, Pressure dependence of hydrogen bonding in a novel H_2O-H_2 clathrate, *Chem. Phys. Lett.*, **257**, 524-530 (1996).
162. Somayazulu, M., L. W. Finger, R. J. Hemley, and H. K. Mao, High-pressure compounds in methane-hydrogen mixtures, *Science*, **271**, 1400-1402 (1996).
163. Hemley, R. J. and H. K. Mao, High-pressure Raman spectroscopy: New windows on matter under extreme conditions, in *Fifteenth International Conference on Raman Spectroscopy* (eds. S. A. Asher and Stein, P.) 1032-1033 (Wiley, New York, 1996).
164. Goncharov, A. F., M. Somayazulu, V. V. Struzhkin, R. J. Hemley and H. K. Mao, New high-pressure low-temperature phase of methane, in *Fifteenth International Conference on Raman Spectroscopy* (eds. S. A. Asher and Stein, P.) 1042-1043 (Wiley, New York, 1996).
165. Shen, G., H. K. Mao and R. J. Hemley, Laser-heating diamond-anvil cell technique: double-sided heating with multimode Nd:YAG laser, in *Advanced Materials '96* (eds. M. Akaishi, Arima, M., Irifune, T., Kikegawa, T., Kondo, K. and al, e.) 149-152 (N.I.R.I.M., Tskuba, Japan, 1996).
166. Loubeyre, P., R. LeToullec, D. Häusermann, M. Hanfland, R. J. Hemley, H. K. Mao, and L. W. Finger, X-ray diffraction and equation of state of hydrogen at megabar pressures, *Nature*, **383**, 702-704 (1996).
167. Goncharov, A. F., V. V. Struzhkin, M. S. Somayazulu, R. J. Hemley, and H. K. Mao, Compression of ice to 210 GPa: Infrared evidence for a symmetric hydrogen bonded phase, *Science*, **273**, 218-220 (1996).
168. Hemley, R. J., and N. W. Ashcroft, Shocking states of matter, *Nature*, **380**, 671-672 (1996).
169. Zha, C. S., T. S. Duffy, R. T. Downs, H. K. Mao, and R. J. Hemley, Sound velocity and elasticity of single-crystal forsterite to 16 GPa, *J. Geophys. Res.*, **101**, 17535-17545 (1996).

1997

170. Hemley, R. J., I. I. Mazin, A. F. Goncharov, and H. K. Mao, Vibron effective charges in dense hydrogen, *Europhys. Lett.*, **37**, 403-407 (1997).
171. Hemley, R. J. and H. K. Mao, Static high-pressure effects in solids, in *Encyclopedia of Applied Physics* (ed. G. L. Trigg) 555-572 (VCH Publishers, New York, 1997).
172. Mazin, I. I., R. J. Hemley, A. F., Goncharov, M. Hanfland, and H. K. Mao, Quantum and classical orientational ordering in dense hydrogen, *Phys. Rev. Lett.*, **78**, 1066-1069 (1997).
173. Yoo, C. S., J. Akella, A. J. Campbell, H. K. Mao, and R. J. Hemley, Detecting phases of iron, *Science*, **275**, 94-96 (1997).
174. Hemley, R. J., Mineral physics, *Geotimes*, **42**, 48-49 (1997).
175. Zha, C. S., T. S. Duffy, R. T. Downs, H. K. Mao, R. J. Hemley, and D. J. Weidner, Single-crystal elasticity of β - Mg_2SiO_4 at high pressure, *Earth Planet. Sci. Lett.*, **147**, E9-E15 (1997).

176. Mao, H. K., R. J. Hemley and A. L. Mao, Diamond-cell research with synchrotron radiation, in *Advances in High Pressure Research in Condensed Matter* (ed. S. K. Sikka) 12-19 (NISCOM, New Delhi, India, 1997).
177. Hemley, R. J., C. Meade, and H. K. Mao, Comment on 'Medium-range order in permanently densified SiO₂ and GeO₂ glass, *Phys. Rev. Lett.*, **79**, 1420 (1997).
178. Hemley, R. J., H. K. Mao, G. Shen, J. Badro, P. Gillet, M. Hanfland, and D. Häusermann, X-ray imaging of stress and strain of diamond, iron, and tungsten at megabar pressures, *Science*, **276**, 1242-1245 (1997).
179. Badro, J., D. M. Teter, R. T. Downs, P. Gillet, R. J. Hemley, and J. L. Barrat, Theoretical study of a five-coordinated silica polymorph, *Phys. Rev. B*, **56**, 5797-5806 (1997).
180. Struzhkin, V. V., A. F. Goncharov, R. J. Hemley, and H. K. Mao, Cascading Fermi resonances and the soft mode in dense ice, *Phys. Rev. Lett.*, **78**, 4446-4449 (1997).
181. Hemley, R. J., Crystals that came in from the cold (Book Review of *Physics of Cryocrystals*, edited by V. G. Manzhelii and Yu. Freiman), *Science*, **276**, 1519 (1997).
182. Struzhkin, V. V., Yu. A. Timofeev, R. J. Hemley, and H. K. Mao, Superconducting T_c and electron-phonon coupling in Nb to 132 GPa: magnetic susceptibility at megabar pressures, *Phys. Rev. Lett.*, **79**, 4262-4265 (1997).
183. Struzhkin, V. V., R. J. Hemley, H. K. Mao, and Yu. A. Timofeev, Superconductivity at 10 to 17 K in compressed sulfur, *Nature*, **390**, 382-384 (1997).
184. Somayazulu, M., R. J. Hemley, H. K. Mao, A. F. Goncharov and L. W. Finger, High-pressure compounds in the methane-hydrogen system: X-ray, infrared, and Raman studies of CH₄(H₂)₂, *Eur. J. Solid State Inorg. Chem.*, **34**, 705-713 (1997).
185. Mao, H. K., G. Shen and R. J. Hemley, Multivariable dependence of Fe/Mg partitioning in the Earth's lower mantle, *Science*, **278**, 2098-2100 (1997).
186. Saxena, S. K., L. S. Dubrovinsky, C. S. Yoo, J. Akella, A. J. Campbell, H. K. Mao, and R. J. Hemley, Detecting phases of iron. Response to Comment by S. K. Saxena and L. S. Dubrovinsky, *Science*, **275**, 96 (1997).
187. Mao, H. K. and R. J. Hemley, High pressure and synchrotron radiation: the new era of megabar research, *NSLS Newsletter*, July, 4-13 (1997).

1998

188. Singh, A. K., H. K. Mao, J. Shu, and R. J. Hemley, Estimation of single-crystal elastic moduli from polycrystalline x-ray diffraction: application to FeO and iron, *Phys. Rev. Lett.*, **80**, 2157-2160 (1998).
189. Hemley, R. J. and H. K. Mao, Static compression experiments on low-Z planetary materials, in *Properties of Earth and Planetary Materials at High Pressure and Temperature* (eds. M. Manghnani and Yagi, T.) 173-183 (American Geophysical Union, Washington, D. C., 1998).
190. Zha, C. S., T. S. Duffy, R. T. Downs, H. K. Mao, R. J. Hemley and D. J. Weidner, Single-crystal elasticity of the α and β polymorphs of Mg₂SiO₄ at high pressure, in *Properties of Earth and Planetary Materials at High Pressure and Temperature* (eds. M. H. Manghnani and Yagi, T.) 9-16 (A.G.U, Washington, D. C., 1998).
191. Mao, H. K., G. Shen, R. J. Hemley and T. S. Duffy, X-ray diffraction with a double hot-plate laser-heated diamond cell, in *Properties of the Earth and Planetary Materials at High Pressure and Temperature* (eds. M. H. Manghnani and Yagi, T.) 27-34 (Am. Geophys. Union, Washington, DC, 1998).

192. Yang, H., R. M. Hazen, C. T. Prewitt, L. W. Finger, R. Lu and R. J. Hemley, High-pressure single-crystal x-ray diffraction and infrared spectroscopic studies of the $C2/m$ - $P2_1/m$ phase transition in cummingtonite, *Am. Mineral.*, **83**, 288-299 (1998).
193. Hemley, R. J., A. F. Goncharov, H. K. Mao, E. Karmon and J. H. Eggert, Spectroscopic studies of p -H₂ to above 200 GPa, *J. Low Temp. Phys.*, **110**, 75-88 (1998).
194. Shu, J., H. K. Mao, J. Hu, Y. Fei and R. J. Hemley, Single-crystal x-ray diffraction of wustite to 30 GPa hydrostatic pressure, *Neues Jahr. Mineral.*, **172**, 309-323 (1998).
195. Teter, D. M., R. J. Hemley, G. Kress and J. Hafner, High-pressure polymorphism in silica, *Phys. Rev. Lett.*, **80**, 2145-2148 (1998).
196. Shieh, S., L. C. Ming, H. K. Mao and R. J. Hemley, Decomposition of phase D in the lower mantle and the fate of dense hydrous silicates in subducting slabs, *Earth Planet. Sci. Lett.*, **159**, 13-23 (1998).
197. Zha, C. S., T. S. Duffy H. K. Mao, R. T. Downs and R. J. Hemley, High-pressure Brillouin scattering of San Carlos olivine, *Earth Planet. Sci. Lett.*, **159**, 25-34 (1998).
198. Shen, G., H. K. Mao, R. J. Hemley, T. S. Duffy, and M. L. Rivers, Melting and crystal structure of iron at high pressures and temperatures, *Geophys. Res. Lett.*, **25**, 373-376 (1998).
199. Zha, C. S., T. S. Duffy, H. K. Mao and R. J. Hemley, Recent progress in high-pressure Brillouin scattering: olivine and H₂O ice, *Review of High-Pressure Science and Technology*, **7**, 739-741 (1998).
200. Singh, A. K., A. Balasingh, H. K. Mao, J. Shu and R. J. Hemley, Interpretation of the lattice strains measured under non-hydrostatic pressure, *Review of High-Pressure Science and Technology*, **7**, 205-210 (1998).
201. Hemley, R. J., A. F. Goncharov, R. Lu, M. Li, V. V. Struzhkin and H. K. Mao, High-pressure synchrotron infrared spectroscopy at the National Synchrotron Light Source, *II Nuovo Cimento D*, **20**, 539-551 (1998).
202. Hemley, R. J., Properties of matter at high pressures and temperatures, in *Sciences of the Earth: An Encyclopedia of Events, People, and Phenomena* (ed. G. A. Good) 523-535 (Garland Publishing, New York, 1998).
203. Goncharov, A. F., R. J. Hemley, H. K. Mao, and J. Shu, New high-pressure excitations in para-hydrogen, *Phys. Rev. Lett.*, **80**, 101-104 (1998).
204. Singh, A. K., A. Balasingh, H. K. Mao, R. J. Hemley and J. Shu, Analysis of lattice strains measured under non-hydrostatic pressure, *J. Appl. Phys.*, **83**, 7567-7575 (1998).
205. Hemley, R. J. and N. W. Ashcroft, The revealing role of pressure in the condensed-matter sciences, *Physics Today*, **51**, 26-32 (1998).
206. Freiman, Yu. A., S. M. Tretyak, A. Jezowski, R. J. Hemley, Broken symmetry phase transition in solid HD: a manifestation of quantum orientational melting, *Low Temp. Phys.*, **24**, 683-688 (1998).
207. Chou, I. M., J. Blank, A. F. Goncharov, H. K. Mao, and R. J. Hemley, In situ observations of a high-pressure phase of H₂O ice, *Science*, **281**, 809-811 (1998).
208. Duffy, T. S., G. Shen, D. L. Heinz, Y. Ma, R. J. Hemley, H. K. Mao and A. K. Singh, Lattice strains in gold and rhenium under non-hydrostatic pressure, in *High-Pressure Materials Research. Materials Research Society Proceedings* (eds. R. Wentzcovitch, Hemley, R. J., Nellis, W. J. and Yu, P.) 145-150 (Materials Research Society, Warrendale, PA, 1998).
209. Mao, H. K., J. Shu, G. Shen, R. J. Hemley, B. Li, and A. K. Singh, Elasticity and rheology of iron above 200 GPa and the nature of the Earth's inner core, *Nature*, **396**, 741-743, 1998; correction (1999).

210. Hemley, R. J., Superconductivity in a grain of salt, *Science*, **281**, 1296-1297 (1998).
211. Hemley, R. J., M. S. Somayazulu, A. F. Goncharov, and H. K. Mao, High-pressure Raman spectroscopy of Ar-H₂ and CH₄-H₂ van der Waals compounds. *Asian J. Phys.* **7**, 319-322 (1998).
212. Hemley, R. J. and H. K. Mao, New phenomena in low-Z materials at megabar pressures. *J. Phys.: Condens. Matter*, **10**, 11157-11167 (1998).
213. Freiman, Yu. A., S. M. Tretyak, A. Jezowski, and R. J. Hemley, Broken symmetry phase transition in solid HD: quantum behavior, *J. Low Temp. Phys.*, **113**, 723-728 (1998).
214. Gillet, P., R. J. Hemley and P. F. McMillan, Vibrational properties at high pressures and temperatures, in *Ultrahigh-Pressure Mineralogy: Physics and Chemistry of the Earth's Deep Interior*, *Rev. Min.* (ed. R. J. Hemley) 525-590 (Mineralogical Society of America, Washington, D.C., 1998).
215. Hemley, R. J., H. K. Mao and R. E. Cohen, High-pressure electronic and magnetic properties of minerals, in *Ultrahigh-Pressure Mineralogy*, *Rev. Min.*, Vol 37 (ed. R. J. Hemley) 591-638 (Mineralogical Society of America, Washington, D.C., 1998).
216. Mao, H. K. and R. J. Hemley, New windows on the Earth's deep interior, in *Ultrahigh-Pressure Mineralogy: Physics and Chemistry of the Earth's Deep Interior*, *Rev. Min.* Vol. 37 (ed. R. J. Hemley) 1-32 (Mineralogical Society of America, Washington, D.C., 1998).
217. Stixrude, L., R. E. Cohen and R. J. Hemley, Theory of minerals at high pressure, in *Ultrahigh-Pressure Mineralogy: Physics and Chemistry of the Earth's Deep Interior*, *Rev. Min.* (ed. R. J. Hemley) 639-671 (Mineralogical Society of America, Washington, D.C., 1998).
218. Hemley, R. J., A. F. Goncharov, V. V. Struzhkin, M. Somayazulu, and H. K. Mao, Transforming ice at megabar pressures, *Abstracts of the International Union of Crystallography High Pressure Workshop*, Nov. 14-16, 1998, Argonne, IL (1998).

1999

219. Merkel, S., R. J. Hemley, and H. K. Mao, Finite elemental modeling of diamond deformation at multimegabar pressures, *Appl. Phys. Lett.*, **74**, 656-658 (1999).
220. Hemley, R. J., H. K. Mao, M. S. Somayazulu, Y. Ma, P. F. McMillan and G. H. Wolf, Investigations of new ceramic materials at high pressures and temperatures, in *Advanced Materials '99 - New Semiconducting Materials: Diamond and Related Materials* (eds. Y. Bando, Akaishi, M., Kanda, H., Matsui, Y., Kobayashi, T., Watanabe, H., Seki, H. and Yamashita, N.) 15-16 (National Institute for Research in Inorganic Materials, Tsukuba, Japan, 1999).
221. Conrad, P. G., C. S. Zha, H. K. Mao, and R. J. Hemley, The high-pressure, single-crystal elasticity of pyrope, *Am. Mineral.*, **84**, 374-383 (1999)
222. Lu, R., A. F. Goncharov, H. K. Mao and R. J. Hemley, Synchrotron infrared microspectroscopy: applications to hydrous minerals, in *Synchrotron X-ray Methods in Clay Science* (eds. D. Schulze, Stucki, J. W. and Bertsch, P. M.) 165-182 (The Clay Minerals Society, Boulder, CO, 1999).
223. Feldman, J. L., J.H. Eggert, J. de Kinder, H. K. Mao, R. J. Hemley, Influence of order-disorder on the vibron excitations of H₂ and D₂ in ortho-para mixed crystals, *J. Low Temp. Phys.*, **115**, 181-216 (1999).

224. Eggert, J. H., E. Karmon, R. J. Hemley, H. K. Mao, and A. F. Goncharov, Pressure-enhanced ortho-para conversion in solid hydrogen up to 58 GPa, *Proc. Nat. Acad. Sci.*, **96**, 12269-12272 (1999).
225. Freiman, Yu. A., S. M. Tretyak, A. Jezowski, and R. J. Hemley, Broken symmetry phase transition in solid p -H₂, o -D₂, and HD: crystal field effects, *Physica B*, **265**, 12-15 (1999).
226. Hemley, R. J., Mineralogy at a crossroads, *Science*, **285**, 1026-1027 (1999).
227. Goncharov, A. F., V. V. Struzhkin, H. K. Mao, and R. J. Hemley, Raman spectroscopy of dense H₂O and the transition to symmetric hydrogen bonds, *Phys. Rev. Lett.*, **83**, 1998-2001 (1999).
228. Rueff, J. P., C. C. Kao, V. V. Struzhkin, J. Badro, J. Shu, R. J. Hemley, and H. K. Mao, High-resolution emission spectroscopic evidence for the pressure-induced high-spin to low-spin transition in FeS, *Phys. Rev. Lett.*, **82**, 3284-3287 (1999).
229. Badro, J., V. V. Struzhkin, J. Shu, R. J. Hemley, H. K. Mao, C. C. Kao, J. P. Rueff, and G. Shen, Magnetism in FeO at megabar pressures from x-ray emission spectroscopy, *Phys. Rev. Lett.*, **83**, 4101-4104 (1999).
230. Duffy, T. S., G. Shen, J. Shu, H. K. Mao, R. J. Hemley, and A. K. Singh, Elasticity, shear strength, and equation of state of molybdenum and gold under non-hydrostatic compression to 24 GPa, *J. Appl. Phys.*, **86**, 6729-6736 (1999).
231. Duffy, T. S., G. Shen, D. L. Heinz, Y. Ma, J. Shu, H. K. Mao, R. J. Hemley, and A. K. Singh, Lattice strains in gold and rhenium under non-hydrostatic compression to 37 GPa, *Phys. Rev. B*, **60**, 15063-15073 (1999).
232. Timofeev, Yu. A., H. K. Mao, V. V. Struzhkin, and R. J. Hemley, Inductive method for investigation of ferromagnetic properties of materials under pressure, *Rev. Sci. Instrum.*, **70**, 4059-4061 (1999).
233. Hemley, R. J., H. K. Mao, M. S. Somayazulu, Y. Ma, P. F. McMillan, and G. H. Wolf, Investigations of new ceramic materials at high pressures and temperatures, in *Proc. 6th NIRIM International Symposium on Advanced Materials (ISAM '99)* 15-16 (Nat. Inst. Res. Inorg. Materials, Tsukuba, Japan, 1999).

2000

234. Struzhkin, V. V., A. F. Goncharov, H. K. Mao, R. J. Hemley, S. W. Moore, J. M. Graybeal, J. Sarrao, and Z. Fisk, Coupled magnon-phonon excitations in Sr₂CuCl₂O₂ at high pressure, *Phys. Rev. B*, **62**, 3895-3899 (2000).
235. Hemley, R. J., J. Badro and D. M. Teter, Polymorphism in crystalline and amorphous silica at high pressures, in *Physics Meets Mineralogy - Condensed Matter Physics in Geosciences* (eds. H. Aoki, Syono, Y. and Hemley, R. J.) 173-204 (Cambridge University Press, Cambridge, England, 2000).
236. Aoki, H., Y. Syono and R. J. Hemley, Physics and mineralogy: the current confluence, in *Physics Meets Mineralogy - Condensed Matter Physics in Geosciences* (eds. H. Aoki, Syono, Y. and Hemley, R. J.) 3-18 (Cambridge University Press, Cambridge, England, 2000).
237. Carpenter, M. A., R. J. Hemley, and H. K. Mao, High-pressure elasticity of stishovite and the $P4_2/mnm \rightarrow Pnnm$ phase transition, *J. Geophys. Res.*, **105**, 10807-10816 (2000).
238. Shieh, S. R., H. K. Mao, J. Konzett, and R. J. Hemley, In situ x-ray diffraction of phase E to 15 GPa, *Am. Mineral.*, **85**, 765-769 (2000).

239. Cohen, R. E., O. Gulseren, and R. J. Hemley, Accuracy in equation of state formulations, *Am. Mineral.*, **85**, 338-344, (2000).
240. Merkel, S., R. J. Hemley, H. K. Mao and D. M. Teter, Finite element modeling and ab initio calculations of megabar stresses in the diamond anvil cell, in *Science and Technology of High Pressure: Proceedings of AIRAPT 17* (eds. M. H. Manghnani, Nellis, W. J. and Nicol, M.) 68-73 (Universities Press, Hyderabad, India, 2000).
241. Hu, J., H. K. Mao, Q. Z. Guo and R. J. Hemley, X-ray diffraction studies at X17C of the NSLS, in *Science and Technology of High Pressure: Proceedings of AIRAPT 17* (eds. M. H. Manghnani, Nellis, W. J. and Nicol, M.) 1039-1042 (Universities Press, Hyderabad, India, 2000).
242. Goncharov, A. F., V. V. Struzhkin, R. J. Hemley, H. K. Mao and Z. Liu, Advances in optical spectroscopy at multimegabar pressures, in *Science and Technology of High Pressure: Proceedings of AIRAPT 17* (eds. M. H. Manghnani, Nellis, W. J. and Nicol, M.) 90-95 (Universities Press, Hyderabad, India, 2000).
243. Zou, G., Y. Z. Ma, H. K. Mao, J. Z. Hu, S. M. Somayazulu and R. J. Hemley, Application of diamond gasket on the XRD study at high pressure and high temperature, in *Science and Technology of High Pressure: Proceedings of AIRAPT 17* (eds. M. H. Manghnani, Nellis, W. J. and Nicol, M. F.) 1107-1108 (Universities Press (India) Limited, Honolulu, HI, 2000).
244. Shieh, S. R., H. K. Mao, R. J. Hemley, and L. C. Ming, In situ x-ray diffraction studies of dense hydrous magnesium silicates at mantle conditions, *Earth Planet. Sci. Lett.*, **177**, 69-80 (2000).
245. Gregoryanz, E., R. J. Hemley, H. K. Mao, and P. Gillet, High-pressure Brillouin scattering of α -quartz: elastic instability and ferroelastic transition, *Phys. Rev. Lett.*, **84**, 3117-3120 (2000).
246. Hemley, R. J., H. K. Mao, and S. A. Gramsch, Pressure-induced transformations in deep mantle and core minerals, *Min. Mag.*, **64**, 157-184 (2000).
247. Struzhkin, V. V., R. J. Hemley, H. K. Mao, Yu. A. Timofeev, and M. I. Eremets, Electronic and magnetic studies of materials to megabar pressures, *Hyperfine Interactions*, **128**, 323-343 (2000).
248. Hemley, R. J., J. Shu, M. A. Carpenter, J. Hu, H. K. Mao, and K. J. Kingma, Strain/order parameter coupling in the ferroelastic transition in dense SiO₂, *Solid State Commun.*, **114**, 527-532 (2000).
249. Zha, C. S., H. K. Mao, and R. J. Hemley, Elasticity of MgO and a primary pressure scale to 55 GPa, *Proc. Nat. Acad. Sci.*, **97**, 13494-13499 (2000).
250. Eremets, M. I., E. Gregoryanz, V. V. Struzhkin, H. K. Mao, R. J. Hemley, N. Mulders, and N. Zimmerman, Electrical conductivity of Xe at megabar pressures, *Phys. Rev. Lett.*, **83**, 2797-2800 (2000).
251. Sobolev, N. V., B. A. Fursenko, S. V. Goryainov, J. Shu, R. J. Hemley, H. K. Mao, F. R. Boyd, Fossilized high pressure from the Earth's deep interior: the coesite-in-diamond barometer, *Proc. Nat. Acad. Sci.*, **97**, 11875-11879 (2000).
252. Kagi, H., R. Lu, P. M. Davidson, A. F. Goncharov, H. K. Mao, and R. J. Hemley, Evidence for ice VI as an inclusion of cuboid diamonds from high P-T near infrared spectroscopy, *Min. Mag.*, **64**, 1089-1097 (2000).
253. Wenk, H. R., S. Matthies, R. J. Hemley, H. K. Mao, and J. Shu, The plastic deformation of iron at pressures of the Earth's inner core, *Nature*, **405**, 1044-1047 (2000).
254. Hemley, R. J., The element of uncertainty, *Nature*, **404**, 240-241 (2000).

255. Klehe, A. K., R. D. McDonald, A. F. Goncharov, V. V. Struzhkin, H. K. Mao, R. J. Hemley, T. Sasaki, W. Hayes, and J. Singleton, Infrared studies of the organic superconductor κ -(BEDT-TTF)₂Cu(SCN)₂ under pressure, *J. Phys.: Condens. Matter*, **12**, L247-L256 (2000).
256. Hemley, R. J., A. F. Goncharov, Z. Liu, H. K. Mao and S. Merkel, High-pressure infrared synchrotron and Raman microspectroscopy of Earth and planetary materials, in *Microbeam Analysis 2000* (eds. D. B. Williams and Shimizu, R.) 87-88 (Institute of Physics, Philadelphia, 2000).
257. Merkel, S., A. F. Goncharov, H. K. Mao, P. Gillet, and R. J. Hemley, Raman spectroscopy of iron to 152 gigapascals: implications for Earth's inner core, *Science*, **288**, 1626-1629 (2000).
258. Hemley, R. J., Effects of high pressure on molecules, *Ann. Rev. Phys. Chem.*, **51**, 763-800 (2000).
259. Sanloup, C., F. Guyot, P. Gillet, G. Fiquet, R. J. Hemley, M. Mezouar, and I. Martinez, Structural changes in liquid Fe at high pressures and high temperatures from synchrotron x-ray diffraction, *Europhys. Lett.*, **52**, 151-157 (2000).
260. Hemley, R. J., H. K. Mao, A. F. Goncharov, M. Eremets and V. V. Struzhkin, The Raman probe of ultrahigh-pressure phenomena, in *ICORS 2000 - Proceedings of the Seventeenth International Conference on Raman spectroscopy* (ed. L. Zhang) 20-25 (2000).
261. Strzheimchny, M. A. and R. J. Hemley, New ortho-para conversion mechanism in dense solid hydrogen, *Phys. Rev. Lett.*, **85**, 5595-5598 (2000).
262. Goncharov, A. F., E. Gregoryanz, H. K. Mao, Z. Liu, and R. J. Hemley, Optical evidence for a nonmolecular phase of nitrogen above 150 GPa, *Phys. Rev. Lett.*, **85**, 1262-1265 (2000).
263. Chou, I. M., A. Sharma, R. C. Burruss, J. Shu, H. K. Mao, R. J. Hemley, A. F. Goncharov, L. A. Stern, and S. H. Kirby, Transformations in methane hydrates, *Proc. Nat. Acad. Sci.*, **97**, 13484-13487 (2000).
264. Hemley, R. J. and P. Dera, Molecular crystals, in *High-Temperature and High-Pressure Crystal Chemistry, Rev. Min. Geochem. Vol. 41* (eds. Hazen, R. M. and R. T. Downs) 335-419 (M.S.A., Washington, D.C., 2000).
265. Kendziora, C. D. Pelloquin, A. Daignere, P. Fournier, Z. Y. Li, R. L. Greene, A. F. Goncharov, V. V. Struzhkin, R. J. Hemley, and H. K. Mao, Polarized electronic Raman scattering in high T_c superconductors, *Physica C*, **341-348**, 2189-2192 (2000).

2001

266. Speziale, S., C. S. Zha, T. S. Duffy, R. J. Hemley, and H. K. Mao, Quasihydrostatic compression of magnesium oxide to 52 GPa: implications for the pressure-volume-temperature equation of state, *J. Geophys. Res.*, **106**, 515-528 (2001).
267. Mao, H. K., J. Xu, V. V. Struzhkin, J. Shu, R. J. Hemley, W. Sturhahn, M. Y. Hu, E. E. Alp, L. Vocadlo, D. Alfè, G. D. Price, M. J. Gillan, M. Schwoerer-Böhning, D. Häusermann, P. Eng, G. Shen, H. Gierffer, R. Lübbbers, and G. Wortmann, Phonon density of states of iron to 153 GPa, *Science*, **292**, 914-916 (2001).
268. Angel, R. J., Frost, D., N. L. Ross, and R. J. Hemley, Stabilities and equations of state of dense hydrous magnesium silicates, *Phys. Earth Planet. Inter.*, **127**, 181-196 (2001).
269. Matsuishi, K., T. Suzuki, S. Onari, E. Gregoryanz, R. J. Hemley, and H. K. Mao, Exciton states of alkylammonium lead-iodide layered perovskite semiconductors under hydrostatic pressure to 25 GPa, *Phys. Status Solidi (b)*, **223**, 177-182 (2001).

270. Goncharov, A. F., M. A. Strzhemechny, H. K. Mao, and R. J. Hemley, Low-frequency Raman excitations in phase I of solid H₂: Role of crystal fields, *Phys. Rev. B*, **63**, 64304, (2001).
271. Eremets, M. I., R. J. Hemley, H. K. Mao, and E. Gregoryanz, Electrical conductivity of semiconducting nitrogen to 240 GPa and its low-pressure stability, *Nature*, **411**, 170-174 (2001).
272. Zou, G., Y. Ma, H. K. Mao, R.J. Hemley, and S.A. Gramsch, A diamond gasket for the laser-heated diamond anvil cell, *Rev. Sci. Instrum.*, **72**, 1298-1301 (2001).
273. Ma, Y., H. K. Mao, R. J. Hemley, S. A. Gramsch, G. Shen, and M. Somayazulu, Two-dimensional energy dispersive x-ray diffraction at high pressures and temperatures, *Rev. Sci. Instrum.*, **72**, 1302-1305 (2001).
274. Chou, I. M., A. Sharma, R. C. Burruss, R. J. Hemley, A. F. Goncharov, L. A. Stern, and S. H. Kirby, Diamond-anvil cell observations of a new methane hydrate phase in the 100-MPa pressure range, *J. Phys. Chem. A*, **105**, 4664-4668 (2001).
275. Williams, Q., and R. J. Hemley, Hydrogen in the deep Earth, *Ann. Rev. Earth Planet. Sci.*, **29**, 365-418 (2001).
276. Antsygina, T. N., K. A. Chishko, Y. A. Freiman, S. M. Tretyak, and R. J. Hemley, Analytical approach to mean field theory of the BSP transition in solid hydrogens under pressure, *J. Low Temp. Phys.*, **122**, 425-432 (2001).
277. Freiman, Y. A., S. M. Tretyak, A. Jezowski, and R. J. Hemley, Self-consistent theory of lattice distortion in solid *p*-H₂, *o*-D₂, and HD, *J. Low Temp. Phys.*, **122**, 537-544 (2001).
278. Feldman, J. L., J. H. Eggert, H. K. Mao, and R. J. Hemley, Computations of vibron excitations and Raman spectra in solid hydrogens, *J. Low Temp. Phys.*, **122**, 389-399 (2001).
279. Hemley, R. J. and H. K. Mao, Progress in cryocrystals to megabar pressures, *J. Low Temp. Phys.*, **122**, 331-344 (2001).
280. Mao, H. K. and R. J. Hemley, Ultrahigh pressure research: a new integrated approach, in *Proc. 8th NIRIM Int. Symp. Adv. Materials (ISAM 2001): Ultra-High Pressure Research -- Novel Process for New Materials--* (eds., Akaishi, M., Sekine, T., Takemura, K., Taniguchi, T., Kobayashi, T., Tajima, K. and Aida, N.) 57-58 (Nat. Inst. Res. Inorg. Materials, Tsukuba, Japan, 2001).
281. Nakano, S., R. J. Hemley, O. Tschauner and H. K. Mao, High-pressure/high-temperature transformations of boron hydride, in *Proc. 8th NIRIM Int. Symp. Adv. Materials (ISAM 2001): Ultra-High Pressure Research --Novel Process for New Materials--* (eds., Akaishi, M., Sekine, T., Takemura, K., Taniguchi, T., Kobayashi, T., Tajima, K. and Aida, N.) 49-50 (Nat. Inst. Res. Inorg. Materials, Tsukuba, Japan, 2001).
282. Matsuishi, K., A. Masui, T. Suzuki, S. Onari, R. J. Hemley and H. K. Mao, Pressure effects on structures and excitons of lead-iodide based self-organized quantum structures, in *Proc. 8th NIRIM Int. Symp. Adv. Materials (ISAM 2001): Ultra-High Pressure Research --Novel Process for New Materials--* (eds., Akaishi, M., Sekine, T., Takemura, K., Taniguchi, T., Kobayashi, T., Tajima, K. and Aida, N.) 49-50 (Nat. Inst. Res. Inorg. Materials, Tsukuba, Japan, 2001).
283. Feodosyev, S. B., I. A. Gospodarev, M. A. Strzhemechny, and R. J. Hemley, Phonon assisted ortho-para conversion in solid H₂ under pressure, *Physica B*, **300**, 186-197 (2001).
284. Gregoryanz, E., A. F. Goncharov, R. J. Hemley, and H. K. Mao, High-pressure amorphous nitrogen, *Phys. Rev. B*, **64**, 052103 (2001).

285. Tschauner, O., H. K. Mao, and R. J. Hemley, New transformations in CO₂ at high pressures and temperatures, *Phys. Rev. Lett.*, **87**, 075701 (2001).
286. Somayazulu, M. A. Madduri, A. F. Goncharov, O. Tschauner, P. F. McMillan, H. K. Mao, and R. J. Hemley, Novel broken symmetry phase from N₂O at high pressures and high temperatures, *Phys. Rev. Lett.*, **87**, 135504 (2001).
287. Hemley, R. J. and H. K. Mao, *In situ* studies of iron under pressure: New windows on the Earth's core, *Internat. Geol. Rev.*, **43**, 1-26 (2001).
288. Eremets, M., V. V. Struzhkin, H. K. Mao, and R. J. Hemley, Superconductivity in boron, *Science*, **293**, 272-274 (2001).
289. Goncharov, A. F., V. V. Struzhkin, E. Gregoryanz, J. Hu, R. J. Hemley, H. K. Mao, G. Lapertot, S. L. Bud'ko, and P. C. Canfield, Raman spectrum and lattice parameters of MgB₂ as a function of pressure, *Phys. Rev. B*, **64**, 100509 (2001).
290. Mao, H. K., C. C. Kao, and R. J. Hemley, Inelastic scattering at ultrahigh pressures, *J. Phys.: Condens. Matter*, **13**, 7847-7858 (2001).
291. Matthies, S., S. Merkel, H. R. Wenk, R. J. Hemley, and H. K. Mao, Effects of texture on the determination of elasticity of polycrystalline ϵ -iron from diffraction measurements, *Earth Planet. Sci. Lett.*, **194**, 201-212 (2001).
292. Struzhkin, V. V., H. K. Mao, J. Hu, M. Schwoerer-Böhning, J. Shu, R. J. Hemley, W. Sturhahn, M.Y. Hu, E. E. Alp, P. Eng, and G. Shen, Nuclear inelastic x-ray scattering of FeO to 48 GPa, *Phys. Rev. Lett.*, **87**, 25550 (2001).
293. Goncharov, A. F., E. Gregoryanz, R. J. Hemley, and H. K. Mao, Spectroscopic studies of the vibrational and electronic properties of solid hydrogen to 285 GPa, *Proc. Nat. Acad. Sci.*, **98**, 14234-14237 (2001).
294. Struzhkin, V. V., Goncharov, A. F., Hemley, R. J., Mao, H. K., Lapertot, G., Bud'ko, S. L., Canfield, P. C., Phonon-assisted electronic topological transition in MgB₂ under pressure, *J. Phys.: Condens. Matter*, **27**, 0106576 (2001).
295. Goncharov, A. F., E. Gregoryanz, H. K. Mao, and R. J. Hemley, Vibrational dynamics of solid molecular nitrogen to megabar pressures, *Low Temp. Phys.*, **27**, 866-869 (2001).
296. Hellwig, H., W. B. Daniels, R. J. Hemley, H. K. Mao, E. Gregoryanz, and Z. Yu, Coherent anti-stokes Raman scattering spectroscopy of solid nitrogen to 22 GPa, *J. Chem. Phys.*, **115**, 10876-10882 (2001).
297. Klehe, A.-K., R. D. McDonald, J. Singleton, A. Kleppe, H. Olijnyk, A. P. Jephcoat, A. F. Goncharov, V. V. Struzhkin, R. J. Hemley, H. K. Mao, and T. Sasaki, Raman scattering and infrared reflectivity of κ -(ET)₂Cu(SCN)₂ under pressure, *Synthetic Metals*, **120**, 857-858 (2001).
298. Araújo, D. P., J. C. Gaspar, Y. Fei, E. Hauri, R. J. Hemley, Mineralogy of diamonds from the Juina kimberlite province, SW Amazon Craton, Brazil: Cathodoluminescence, infrared spectroscopy, nitrogen content, and carbon and nitrogen isotopes, *Rev. Brasil. Geocien.* **31**, 669-671 (2001).

2002

299. Strzhemechny, M. A., R. J. Hemley, H. K. Mao, A. F. Goncharov, and J. H. Eggert, Ortho-para conversion of solid hydrogen at high pressure, *Phys. Rev. B*, **66**, 014103 (2002).
300. Brazhkin, V. V., A. G. Lyapin and R. J. Hemley, Harder than diamond: dreams and reality, *Phil. Mag., A*, **82**, 231-253 (2002).

301. Merkel, S., A. P. Jephcoat, J. Shu, H. K. Mao, P. Gillet, and R. J. Hemley, Equation of state elasticity, and shear strength of pyrite at high pressure, *Phys. Chem. Minerals* **29**, 1-9 (2002).
302. Sanloup, C. H. K. Mao, and R. J. Hemley, High-pressure transformations in xenon hydrate, *Proc. Nat. Acad. Sci.*, **99**, 25-28 (2002).
303. Timofeev, Y. A., Struzhkin, R. J. Hemley, H. K. Mao, and E. A. Gregoryanz, Improved techniques for measurement of superconductivity in diamond anvil cells by magnetic susceptibility, *Rev. Sci. Instrum.*, **73**, 371-377 (2002).
304. Goncharov, A. F., V. V. Struzhkin, E. Gregoryanz, H. K. Mao, R. J. Hemley, G. Lapertot, S. L. Bud'ko, P. C. Canfield and I. I. Mazin, Pressure dependence of the Raman spectrum, lattice parameters and superconducting critical temperature of MgB₂, in *Superconducting Magnesium Diboride* (ed., A. Narlikar) 339-350 (Nova Science Publishers, Huntington, N.Y., 2002).
305. Gregoryanz, E., V. V. Struzhkin, R. J. Hemley, M. I. Erements, H. K. Mao, and Y. Timofeev, Superconductivity in the chalcogens up to multimegabar pressures, *Phys. Rev. B*, **65**, 064504 (2002).
306. Hemley, R. J., M. I. Erements and H. K. Mao, Progress in experimental studies of insulator-metal transitions at multimegabar pressures, in *Frontiers of High Pressure Research II* (eds. H. D. Hochheimer, Kuchta, B., Dorhout, P. K. and Yarger, J. L.) 201-216 (Kluwer, Amsterdam, 2002).
307. Sharma, A., J. H. Scott, G. D. Cody, M. L. Fogel, R. M. Hazen, R. J. Hemley, and W. T. Huntress, Observations of microbial activity at gigapascal pressures, *Science*, **295**, 1514-1516 (2002).
308. Merkel, S., H. R. Wenk, J. Shu, G. Shen, P. Gillet, H. K. Mao, and R. J. Hemley, Deformation of polycrystalline MgO at pressures of the lower mantle, *J. Geophys. Res.*, **107**, 2271 (2002).
309. Xu, J., H. K. Mao, R. J. Hemley and E. Hines, The moissanite anvil cell: a new tool for high-pressure research, *J. Phys.: Condens. Matter*, **14**, 11543-11548 (2002).
310. Hu, J., J. Xu, M. Somayazulu, Q. Z. Guo, R. J. Hemley and H. K. Mao, X-ray diffraction and laser heating: application of moissanite anvil cell, *J. Phys.: Condens. Matter*, **14**, 10479-10481 (2002).
311. Xu, J., H. K. Mao and R. J. Hemley, The gem anvil cell: high-pressure behaviour of diamond and related materials, *J. Phys.: Condens. Matter*, **14**, 11549-11552 (2002).
312. Guo, Q., H. K. Mao, J. Hu, J. Shu and R. J. Hemley, The phase transitions of CoO under static pressure to 104 GPa, *J. Phys.: Condens. Matter*, **14**, 11369-11374 (2002).
313. Liu, Z., J. Hu, H. Yang, H. K. Mao and R. J. Hemley, High-pressure synchrotron x-ray diffraction and infrared microspectroscopy: applications to dense hydrous phases, *J. Phys.: Condens. Matter*, **14**, 10641-10646 (2002).
314. Matsuiishi, K., E. Gregoryanz, H. K. Mao and R. J. Hemley, Brillouin and Raman scattering of fluid and solid hydrogen at high pressures and temperatures, *J. Phys.: Condens. Matter*, **14**, 10631-10636 (2002).
315. Nakano, S., R. J. Hemley, E. Gregoryanz, A. F. Goncharov and H. K. Mao, Pressure-induced transformations of molecular boron hydride, *J. Phys.: Condens. Matter*, **14**, 10453-10456 (2002).
316. Mao, W. L., J. Shu, J. Hu, R. J. Hemley and H. K. Mao, Displacive transition in magnesiowüstite, *J. Phys.: Condens. Matter*, **14**, 11349-11354 (2002).

317. Hazen, R. M., N. Boctor, J. A. Brandes, G. D. Cody, R. J. Hemley, A. Sharma and H. S. Yoder, High pressure and the origin of life, *J. Phys.: Cond. Matter*, **14**, 11489-11494 (2002).
318. Struzhkin, V. V., M. I. Erements, W. Gan, H. K. Mao, and R. J. Hemley, Superconductivity in dense lithium, *Science*, **298**, 1213-1215 (2002).
319. Sanloup, C., R. J. Hemley, and H. K. Mao, Evidence for xenon silicates at high pressure and temperature, *Geophys. Res. Lett.*, **29**, 1883 (2002).
320. Hemley, R. J. and H. K. Mao, New windows on earth and planetary interiors, *Mineral. Mag.*, **66**, 791-811 (2002).
321. Mao, W. L., H. K. Mao, A. F. Goncharov, V. V. Struzhkin, Q. Guo, J. Hu, J. Shu, R. J. Hemley, M. Somayazulu, and Y. Zhao, Hydrogen clusters in clathrate hydrate, *Science* **297**, 2247-2249 (2002).
322. Klug, D. D., M. Z. Zgierski, J. S. Tse, Z. Liu, J. R. Kincaid, K. Czarnecki, and R. J. Hemley, Doming modes and dynamics of model heme compounds, *Proc. Nat. Acad. Sci.*, **99** 12526-12530 (2002).
323. Hemley, R. J. and H. K. Mao, Overview of static high pressure science, in *High-Pressure Phenomena, Proceedings of the International School of Physics, "Enrico Fermi" Course CXLVII* (eds., R. J. Hemley, G. L. Chiarotti, M. Bernasconi, and L. Ulivi) 3-40 (IOS Press, Amsterdam, 2002).
324. Struzhkin, V. V., E. Gregoryanz, H. K. Mao, R. J. Hemley and Y. A. Timofeev, New methods for investigating superconductivity at very high pressures, in *High Pressure Phenomena* (eds., R. J. Hemley, G. L. Chiarotti, M. Bernasconi, and L. Ulivi) 275-296 (IOS Press/Societa Italiana di Fisica, Amsterdam, 2002).
325. Goncharov, A. F., V. V. Struzhkin, E. Gregoryanz, R. J. Hemley, H. K. Mao, N. Boctor and E. Huang, Raman scattering of metals to very high pressures, in *High-Pressure Phenomena, Proceedings of the International School of Physics, "Enrico Fermi" Course CXLVII* (eds., R. J. Hemley, G. L. Chiarotti, M. Bernasconi, and L. Ulivi) 297-313 (IOS Press, Amsterdam, 2002).
326. Yan, C. S., Y. K. Vohra, H. K. Mao and R. J. Hemley, Very high growth rate chemical vapor deposition of single-crystal diamond, *Proc. Nat. Acad. Sci.*, **99**, 12523-12525 (2002).
327. Gregoryanz, E., A. F. Goncharov, R. J. Hemley, H. K. Mao, M. Somayazulu, and G. Shen, Raman, infrared, and x-ray evidence for new phases of nitrogen at high pressures and temperatures, *Phys. Rev. B*, **66**, 224108 (2002).
328. Dera, P, C. T. Prewitt, N. Boctor, and R. J. Hemley, Characterization of a high-pressure phase of silica from the Martian meteorite Shergotty, *Am. Mineral.*, **87**, 1018-1023 (2002).
329. Freiman, Y. A., S. M. Tretyak, A. Jezowski, R. J. Hemley, Quantum crystals under pressure as a probe of many-body forces, *J. Low Temp. Phys.*, **126**, 703-708 (2002).
330. Hemley, R. J., The high-pressure frontier, in *3^{eme} Form Technologie des Hautes Pressions* (eds. J. P. Petitet and deResseguier, T.), (Reseau Hautes Pressions, Collognes-la-Rouge, 2002).

2003

331. Gregoryanz, E., R. J. Hemley, H. K. Mao, and R. E. Cohen, High pressure elasticity of alpha-quartz: Instability and ferroelastic transition, Reply to Comment by M. Müser and P. Schöffel, *Phys. Rev. Lett.*, **90**, 079702 (2003).
332. Lin, J. F., D. L. Heinz, H. K. Mao, R. J. Hemley, J. M. Devine, J. Li, and G. Shen, Stability of magnesiowustite in Earth's lower mantle, *Proc. Nat. Acad. Sci.*, **100**, 4405-4408 (2003).

333. Merkel, S., H. R. Wenk, J. Badro, G. Montagnac, P. Gillet, H. K. Mao, and R. J. Hemley, Deformation of (Mg_{0.9}, Fe_{0.1}) SiO₃ perovskite aggregates up to 32 GPa, *Earth Planet. Sci. Lett.*, **209**, 351-360 (2003).
334. Ma, Y., R. J. Hemley, C. T. Prewitt, G. Zou, and H. K. Mao, High P-T x-ray diffraction of study β -boron to 30 GPa, *Phys. Rev. B*, **67**, 174116 (2003).
335. Matsuishi, K., E. Gregoryanz, H. K. Mao, and R. J. Hemley, Equation of state and intermolecular interactions in fluid hydrogen from Brillouin scattering at high pressures and temperatures, *J. Chem. Phys.*, **118**, 10683-10695 (2003).
336. Song, Y., M. Somayazulu, H. K. Mao, R. J. Hemley, and D. R. Herschbach, High pressure structure and equation of state of nitrosonium nitrate from synchrotron x-ray diffraction, *J. Chem. Phys.*, **118**, 8350-8356 (2003).
337. Song, Y., R. J. Hemley, Z. Liu, M. Somayazulu, H. K. Mao, and D. R. Herschbach, High-pressure stability, transformations and vibrational dynamics of nitrosonium nitrate from synchrotron infrared and Raman spectroscopy, *J. Chem. Phys.*, **119**, 2232-2240 (2003).
338. Eremets, M. I., V. V. Struzhkin, H. K. Mao, and R. J. Hemley, Exploring superconductivity in low-Z materials at megabar pressures, *Physica B*, **329**, 1312-1316 (2003).
339. Hellwig, H., A. F. Goncharov, H. K. Mao, E. Gregoryanz, and R. J. Hemley, Brillouin and Raman spectroscopy of the ferroelastic rutile-to-CaCl₂ transition in SnO₂ at high pressure, *Phys. Rev. B*, **67**, 4110-4118 (2003).
340. Gregoryanz, E., A. F. Goncharov, K. Matsuishi, H. K. Mao, and R. J. Hemley, Raman spectroscopy of hot dense hydrogen, *Phys. Rev. Lett.*, **90**, 175701 (2003).
341. Mao, W. L., H. K. Mao, P. J. Eng, T. P. Trainor, M. Newville, C.-C. Kao, D. L. Heinz, J. Shu, Y. Meng, and R. J. Hemley, Bonding changes in compressed superhard graphite, *Science*, **302**, 425-427 (2003).
342. Antsygina, T. N., S. M. Tret'yak, Y. A. Freiman, and R. J. Hemley, Orientational ordering in solid hydrogens with J=1 in the presence of a crystal field, *Low Temp. Phys.*, **29**, 378-381 (2003).
343. Hellwig, H., R. J. Hemley and R. E. Cohen, Micro-Brillouin investigations of relaxor ferroelectrics, *Fundamental Physics of Ferroelectrics: AIP Conference Proceedings*, **677**, 65-73 (2003).
344. Strzheimchny, M. A., and R. J. Hemley, Ortho-para conversion in the solid hydrogens at high pressure, *Low Temp. Phys.*, **29**, 703 (2003).
345. Liu, Z. X., G. A. Lager, R. J. Hemley, and N. L. Ross, Synchrotron infrared spectroscopy of OH-chondrodite and OH-clinohumite at high pressure, *Am. Mineral*, **88**, 1412-1415 (2003).
346. Freiman, Y. A., S. M. Tret'yak, M. Sergei, T. N. Antsygina, and R. J. Hemley, Novel Phase behavior in quantum rotors, *J. Low Temp. Phys.*, **133**, 251-260 (2003).
347. Goncharov, A. F., E. Gregoryanz, R. J. Hemley, and H. K. Mao, Molecular character of the metallic high-pressure phase of oxygen, *Phys. Rev. B*, **68**, 100102 (2003).
348. Mao, W. L., H. K. Mao, C.-S. Yan, J. Shu, J. Hu, and R. J. Hemley, Generation of ultrahigh pressure using single-crystal CVD diamonds anvils, *Appl. Phys. Lett.*, **83**, 5190-5192 (2003).
349. Lin, J. F., J. Shu, H. K. Mao, and R. J. Hemley, G. Shen, Amorphous boron gasket in diamond anvil cell research, *Rev. Sci. Instrum.*, **74**, 4732-4736 (2003).
350. Lin, J. F., V. V. Struzhkin, W. Sturhahn, E. Huang, J. Zhao, M. Y. Hu, E. E. Alp, H. K. Mao, N. Boctor, and R. J. Hemley, Sound velocities of iron-nickel and iron-silicon alloys in the Earth's core, *Geophys. Res. Lett.*, **30**, 2112 (2003).

351. Chen, M., J. Shu, H. K. Mao, X. Xie, and R. J. Hemley, Natural occurrence and synthesis of two new post-spinel polymorphs of chromite, *Proc. Nat. Acad. Sci.*, **100**, 14651-14654 (2003).
352. Song, Y., R. J. Hemley, H. K. Mao, Z. X. Liu, and R. J. Hemley, New phases of N₂O₄ at high pressures and high temperatures, *Chem. Phys. Lett.*, **382**, 686-692 (2003).
353. Li, J., C. Hadidiacos, H. K. Mao, Y. Fei, and R. J. Hemley, Behavior of thermocouples under high pressure in a multi-anvil apparatus, *High Pressure Res.*, **23**, 389-401 (2003).
354. Hemley, R. J., X. Liu, E. Gregoryanz, and H. K. Mao, Infrared and Raman microspectroscopy of minerals under pressure. *Microspectrosc. Microanal.* **9**, 1098-1099 (2003).

2004

355. Santoro, M., E. Gregoryanz, H. K. Mao, and R. J. Hemley, New phase diagram of oxygen at high pressure and temperature, *Phys. Rev. Lett.*, **93**, 265701 (2004).
356. Lin, J. F., V. V. Struzhkin, H. K. Mao, R. J. Hemley, Magnetic transition in compressed Fe₃C from x-ray emission spectroscopy, *Phys. Rev. B*, **70**, 212405 (2004).
357. Chen, X. J., V. V. Struzhkin, R. J. Hemley, H. K. Mao, and C. Kendziora, High-pressure phase diagram of Bi₂Sr₂CaCu₂O_{8+d} single crystals, *Phys. Rev. B*, **70**, 214502 (2004).
358. Yoshimura, Y., H. K. Mao, and R. J. Hemley, Transformation of ice in aqueous KCl solution to a high-pressure, low-temperature phase, *Chem. Phys. Lett.*, **400**, 511-514 (2004).
359. Slebobnick, C., J. Zhao, R. Angel, B. E. Hanson, Y. Song, Z. Liu, and R. J. Hemley, High pressure study of Ru₃(CO)₁₂ by x-ray diffraction, Raman and infrared spectroscopy, *Inorg. Chem.*, **43**, 5245-5252 (2004).
360. Gregoryanz, E., C. Sanloup, M. Somayazulu, J. Badro, G. Fiquet, H. K. Mao, and R. J. Hemley, Synthesis and characterization of binary noble metal nitride: PtN, *Nature Materials*, **3**, 249-297 (2004).
361. Zha, C. S., H. K. Mao, and R. J. Hemley, Elasticity of dense helium, *Phys. Rev. B*, **70**, 174107 (2004).
362. Mao, W. L., W. Sturhahn, D. L. Heinz, H. K. Mao, J. Shu, and R. J. Hemley, Nuclear resonant x-ray scattering of iron hydride at high pressure, *Geophys. Res. Lett.*, **31**, L15618 (2004).
363. Liu, Z., J. Xu, H. Scott, Q. Williams, H. K. Mao, and R. J. Hemley, Moissanite (SiC) as windows and anvils for high-pressure infrared spectroscopy, *Rev. Sci. Instrum.*, **75**, 5026 (2004).
364. Lin, J. F., M. Santoro, V. V. Struzhkin, H. K. Mao, and R. J. Hemley, In situ high pressure-temperature Raman spectroscopy technique with laser-heated diamond anvil cells, *Rev. Sci. Instrum.*, **75**, 3302 (2004).
365. Eremets, M. I., A. G. Gavriliuk, N. R. Serebryanaya, I. A. Trojan, D. A. Dzivenko, R. Boehler, M. Somayazulu, H. K. Mao, and R. J. Hemley, Structural transformation of molecular nitrogen to a single-bonded atomic state at high pressures, *J. Chem. Phys.*, **121**, 11296-11300 (2004).
366. Anand, M. L., A. Taylor, M. A. Nazarov, J. Shu, H. K. Mao and R. J. Hemley. Space weathering on airless planetary bodies: clues from the lunar mineral hapkeite. *Proc. Nat. Acad. Sci.* **101**, 6847-6851 (2004).

367. Yan, C. S., H. K. Mao, W. Li, J. Qian, Y. Zhao and R. J. Hemley. Ultrahard single crystal diamond from chemical vapor deposition. *Phys. Stat. Sol. A* **201**, 25-27 (2004).
368. Xu, J., H. K. Mao, R. J. Hemley and E. Hines. Large volume high pressure cell with supported moissanite anvils. *Rev. Sci. Instrum.* **75**, 1034-1038 (2004).
369. Xu, J., Y. Ding, S. D. Jacobsen, H. K. Mao, R. J. Hemley, J. Zhang, J. Qian, C. Pantea, S. C. Vogel, D. J. Williams and Y. Zhao. Powder neutron diffraction of wüstite ($\text{Fe}_{0.93}\text{O}$) to 12 GPa using large moissanite anvils. *High Pressure. Res.* **24**, 247-253 (2004).
370. Struzhkin, V. V., H. K. Mao, W. L. Mao, R. J. Hemley, W. Sturhahn, E. E. Alp, C. L'Abbe, M. Y. Hu and D. Errandonea. Phonon density of states and elastic properties, of Fe-based materials under compression. *Hyperfine Interactions* **153**, 3-15 (2004).
371. Struzhkin, V. V., R. J. Hemley and H. K. Mao. New condensed matter probes for diamond anvil cell technology. *J. Phys.: Cond. Matter* **16**, 1-16 (2004).
372. Scott, H. P., R. J. Hemley, H. K. Mao, D. R. Herschbach, L. E. Fried, W. M. Howard and S. Bastea. Generation of methane in the Earth's mantle: in-situ high P-T measurements of carbonate reduction. *Proc. Nat. Acad. Sci.* **101**, 14023-14026 (2004).
373. Santoro, M., J. F. Lin, H. K. Mao and R. J. Hemley. In situ high P-T Raman spectroscopy and laser heating of carbon dioxide. *J. Chem. Phys.* **121**, 2780-2787 (2004).
374. Merkel, S., H. R. Wenk, P. Gillet, H. K. Mao and R. J. Hemley. Deformation of polycrystalline iron up to 30 GPa and 1000 K. *Phys. Earth Planet. Inter.* **145**, 239-251 (2004).
375. Meng, Y., H. K. Mao, P. J. Eng, T. P. Trainor, M. Newville, M. Y. Hu, C. Kao, J. Shu, D. Hausermann and R. J. Hemley. The formation of sp^3 bonding in compressed BN. *Nature Materials* **3**, 111-114 (2004).
376. Mao, W. L., G. Shen, V. B. Prakapenka, Y. Meng, A. J. Campbell, D. L. Heinz, J. Shu, R. J. Hemley and H. K. Mao. Ferromagnesian postperovskite silicates in the D" layer of the Earth. *Proc. Nat. Aca. Sci.* **101**, 15867-15869 (2004).
377. Ma, Y., M. Somayazulu, G. Shen, H. K. Mao, J. Shu and R. J. Hemley. In situ x-ray diffraction studies of iron to Earth-core conditions. *Phys. Earth Planet. Inter.* **143-144**, 455-467 (2004).
378. Lokshin, K. A., Y. Zhao, D. He, W. L. Mao, H. K. Mao, R. J. Hemley, M. V. Lobanov and M. Greenblatt. Structure and dynamics of hydrogen molecules in thge novel clathrate hydrate by high pressure neutron diffraction. *Phys. Rev. Lett* **93**, 125503 (2004).
379. Lin, J. F., W. Sturhahn, J. Zhao, G. Shen, H. K. Mao and R. J. Hemley. Absolute temperature measurement in the diamond anvil cell. *Geophys. Res. Lett* **31**, 14611 (2004).
380. Lin, J. F., O. Degtyareva, C. Prewitt, P. Dera, S. Nagayoshi, E. Gregoryanz, H. K. Mao and R. J. Hemley. Crystal structure of a high pressure-temperature phase of corundum by situ x-ray diffraction. *Nature Materials* **3**, 389-393 (2004).
381. Lin, J. F., B. Militzer, V. Struzhkin, E. Gregoryanz, R. J. Hemley and H. K. Mao. High pressure-temperature Raman measurements of H_2O melting to 22 GPa. *J. Chem. Phys.* **121**, 8423-8427 (2004).
382. Lin, J. F., Y. Fei, W. Sturhahn, J. Zhao, H. K. Mao and R. J. Hemley. Magnetic transition and sound velocities of Fe_3S at high pressure: implications for Earth and planetary cores. *Earth Planet Sci. Lett.*, **226**, 33-40 (2004).
383. Li, J., V. V. Struzhkin, H. K. Mao, J. Shu, R. J. Hemley, Y. Fei, B. Mysen, P. Dera, V. Prakapenka and G. Shen. Electronic spin state of iron in lower mantle perovskite. *Proc. Nat. Acad. Sci.*, **101**, 14027-14030 (2004).

384. Klug, D. D., J. S. Tse, Z. Liu, X. Gonze and R. J. Hemley. Anomalous transformations in ice VII. *Phys. Rev. B*, **70**, 144113 (2004).
385. Hemley, R. J. and H. K. Mao. New findings in static high-pressure science, in *Proceedings of the 13th APS Conference on Shock-compression of Condensed Matter* (eds. M. D. Furnish, Gupta, Y. M. and Forbes, J. W.) 17-26 (American Institute of Physics, Argonne, IL, 2004).
386. Guthrie, M., C. A. Tulk, C. J. Benmore, J. Xu, J. L. Yarger, D. D. Klug, J. S. Tse, H. K. Mao and R. J. Hemley. The formation and structure of a dense octahedral glass. *Phys. Rev. Lett.*, **93**, 115502 (2004).
387. Freiman, Y. A., S. M. Tret'yak, T. N. Antsygina and R. J. Hemley. Magnetic quantum rotors. *J. Low Temp. Phys.*, **134**, 535-540 (2004).
388. Eremets, M. I., M. Y. Popov, I. A. Trojan, V. N. Denisov, R. Boehler and R. J. Hemley. Polymerization of nitrogen in sodium azide. *J. Chem. Phys.*, **120**, 10618-10623 (2004).
389. Chen, X. J., V. V. Struzhkin, S. Kung, H. K. Mao, R. J. Hemley and A. N. Christensen. Pressure-induced phonon frequency shifts in transition-metal nitrides. *Phys. Rev. B*, **70**, 104501 (2004).
390. Charles, S. J., J. E. Butler, B. N. Feygelson, M. Newton, D. L. Carroll, J. W. Steeds, H. Darwsh, C. S. Yan and R. J. Hemley. Characterization of nitrogen-doped, chemical vapor deposited single crystal diamond before and after high temperature, high-pressure annealing. *Phys. Stat. Sol.*, **24**, 2473-2485 (2004).

2005

391. Degtyareva, O., E. Gregoryanz, H. K. Mao, and R. J. Hemley, Crystal structure of sulfur and selenium at pressures up to 160 GPa, *High Press. Res.*, **25**, 17-33 (2005).
392. Hemley, R. J., Y. C. Chen, and C. S. Yan, Growing diamond crystals by chemical vapor deposition, *Elements*, **1**, 39-43 (2005).
393. Degtyareva, O., E. Gregoryanz, M. Somayazulu, P. Dera, H. K. Mao, and R. J. Hemley, Novel chain structures in group VI elements, *Nature Materials*, **4**, 152-156 (2005).
394. Cai, Y. Q., H. K. Mao, P. C. Chow, J. S. Tse, Y. Ma, S. Patchkovskii, J. F. Shu, V. Struzhkin, R. J. Hemley, H. Ishii, C. C. Chen, I. Jarrige, C. T. Chen, S. R. Shieh, E. P. Huang, and C. C. Kao, Ordering of hydrogen bonds in high-pressure low-temperature H₂O, *Phys. Rev. Lett.*, **94**, 025502 (2005).
395. Mao, W. L., V. V. Struzhkin, H. K. Mao, and R. J. Hemley, Pressure-temperature stability of the van der Waals compound (H₂)₄CH₄, *Chem. Phys. Lett.*, **402**, 66-70 (2005).
396. Okuchi, T., R. J. Hemley, and H. K. Mao, Radio frequency probe with improved sensitivity for diamond anvil cell nuclear magnetic resonance, *Rev. Sci. Instrum.*, **76**, 026111 (2005).
397. Ding, Y., J. Xu, C. T. Prewitt, R. J. Hemley, H. K. Mao, J. A. Cowan, J. Zhang, J. Qian, S. C. Vogel, K. Lokshin, and Y. Zhao, Variable pressure-temperature neutron diffraction of wustite (Fe_{1-x}O): Absence of long-range magnetic order to 20 GPa, *Appl. Phys. Lett.*, **86**, 052505 (2005).
398. Hemley, R. J., H. K. Mao, and V. V. Struzhkin, Synchrotron radiation and high pressure: new light on materials under extreme conditions, *J. Synch. Radiation*, **12**, 135-154 (2005).
399. Chen, X. J., V. V. Struzhkin, Z. Wu, M. Somayazulu, J. Qian, S. Kung, A. N. Christensen, Y. Zhao, R. E. Cohen, H. K. Mao, and R. J. Hemley, Hard superconducting nitrides, *Proc. Nat. Acad. Sci.*, **102**, 3198-3201 (2005).

400. Ahart, M., R. E. Cohen, V. V. Struzhkin, E. Gregoryanz, D. Rytz, S. Prosandeev, H. K. Mao, and R. J. Hemley, High-pressure scattering and x-ray diffraction study of the relaxor ferroelectric $0.96\text{Pb}(\text{Zn}_{1/3}\text{Nb}_{2/3})\text{O}_3 - 0.04\text{PbTiO}_3$, *Phys. Rev. B*, **71**, 144102 (2005).
401. Gregoryanz, E., O. Degtyareva, M. Somayazulu, R. J. Hemley, and H. K. Mao, Melting of dense sodium, *Phys. Rev. Lett.*, **94**, 185502 (2005).
402. Lin, J. F., E. Gregoryanz, V. V. Struzhkin, M. Somayaulu, H. K. Mao and R. J. Hemley, Melting behavior of H_2O at high pressures and temperatures, *Geophys. Res. Lett.*, **32**, L11306 (2005).
403. Merkel, S., J. Shu, P. Gillet, H. K. Mao and R. J. Hemley, X-ray diffraction study of the single crystal elastic moduli of ϵ -Fe up to 30 GPa, *J. Geophys. Res.*, **10**, B05201 (2005).
404. Goncharov, A. F., V. V. Struzhkin, H. K. Mao, and R. J. Hemley, Spectroscopic evidence for broken symmetry transitions in dense lithium up to megabar pressures, *Phys. Rev. B*, **71**, 184114 (2005).
405. Degtyareva, O., E. Gregoryanz, M. Somayazulu, H. K. Mao and R. J. Hemley, Crystal structures of superconducting phases of S and Se, *Phys. Rev. B*, **71**, 214140 (2005).
406. Lin, J. F., W. Sturhahn, J. Zhao, G. Shen, H. K. Mao and R. J. Hemley, Sound velocities of hot dense iron: Birch's law revisited, *Science*, **308**, 1892-1894 (2005).
407. Lin, J. F., V. Struzhkin, S. D. Jacobsen, M. Y. Hu, P. Chow, J. Kung, H. Liu, H. K. Mao, and R. J. Hemley, Spin transition of iron in magnesiowüstite in Earth's lower mantle, *Nature*, **436**, 377-380 (2005).
408. Ding, Y., H. Liu, J. Xu, C. T. Prewitt, R. J. Hemley and H. K. Mao, Zone-axis diffraction study of pressure induced inhomogeneity in single-crystal Fe_{1-x}O , *Appl. Phys. Lett.*, **87**, 041912 (2005).
409. Mao, W. L., Y. Meng, G. Shen, V. B. Prakapenka, A. J. Campbell, D. L. Heinz, J. Shu, R. Caracas, R. E. Cohen, Y. Fei, R. J. Hemley and H. K. Mao, Iron-rich silicates in the Earth's D" Layer, *Proc. Nat. Acad. Sci.*, **102**, 9751-9753 (2005).
410. Lin, J. F., V. V. Struzhkin, S. D. Jacobsen, G. Shen, V. B. Prakapenka, H. K. Mao and R. J. Hemley, X-ray emission spectroscopy with a laser-heated diamond anvil cell: a new experimental probe of the spin state of iron in the earth's interior, *J. Synch. Radiation*, **12**, 637-641 (2005).
411. Jacobsen, S. D., J. F. Lin, R. J. Angel, G. Shen, V. B. Prakapenka, P. Dera, H. K. Mao and R. J. Hemley, Single crystal synchrotron x-ray diffraction study of wüstite and magnesiowüstite at lower-mantle pressures, *J. Synch. Radiation*, **12**, 557-583 (2005).
412. Okuchi, T., G. D. Cody, H. K. Mao and R. J. Hemley, Hydrogen bonding and dynamics of methanol by high-pressure diamond anvil cell NMR, *J. Chem. Phys.*, **122**, 244509 (2005).
413. Chen, X. J., V. V. Struzhkin, Z. Wu, R. E. Cohen, S. Kung, H. K. Mao and R. J. Hemley, Electronic stiffness of superconducting single crystal niobium nitride under pressure, *Phys. Rev. B*, **72**, 094515 (2005).
414. Freiman, Y.A., S. M. Tret'yak, H. K. Mao, and R. J. Hemley, Entropy-driven reentrant phase transitions in even- J /odd- J mixtures of linear rotors, *J. LowTemp. Phys.*, **139**, 765-772 (2005).
415. Okuchi, T., H. K. Mao, and R. J. Hemley, A new gasket material for higher resolution in NMR in the diamond anvil cell, in *Advances in High-Pressure Technology for Geophysical Applications* (eds. J. Chen, Wang, Y., Duffy, T., Shen, G. and Dobrzhinetskaya, L.) 503-509 (Elsevier, Amsterdam, 2005).

416. Sharma, A., G. D. Cody, J. Scott, and R. J. Hemley, Molecules to microbes: in-situ studies of organic systems under hydrothermal conditions, in *Chemistry Under Extreme Conditions* (ed., Manaa, R.) 83-108 (Elsevier Science, Amsterdam, 2005).
417. Song, Y., R. J. Hemley, H. K. Mao, and D. R. Herschbach, Nitrogen-containing molecular systems at high pressures and temperatures, in *Chemistry Under Extreme Conditions* (ed., Manaa, R.) 189-222 (Elsevier Science, Amsterdam, 2005).
418. Santoro, M., J. F. Lin, V. V. Struzhkin, H. K. Mao and R. J. Hemley, In situ Raman spectroscopy with laser-heated diamond anvil cells, in *Advances in High-Pressure Technology for Geophysical Applications* (eds. J. Chen, Wang, Y., Duffy, T., Shen, G. and Dobrzhinetskaya, L.) 413-423 (Elsevier Science, Amsterdam, 2005).
419. Lin, J. F., W. Sturhahn, J. Zhao, G. Shen, R. J. Hemley and H. K. Mao, Nuclear resonant inelastic x-ray scattering and synchrotron Mössbauer spectroscopy with laser-heated diamond anvil cells, in *Frontiers in High-Pressure Research* (eds., J. Chen, Wang, Y., Duffy, T., Shen, G. and Dobrzhinetskaya, L.) 397-411 (Elsevier Science, Amsterdam, 2005).
420. Song, Y., Z. Liu, R. J. Hemley, H. K. Mao and D. R. Herschbach, High-pressure vibrational spectroscopy of sulfur dioxide, *J. Chem. Phys.*, **122**, 174511 (2005).
421. Lipinska-Kalita, K. E., S. A. Gramsch, P. E. Kalita, R. J. Hemley, In situ Raman scattering studies of high-pressure stability and transformations in the matrix of a nanostructured glass-ceramic composite, *J. Raman Spectrosc.*, **36**, 938-945 (2005).
422. Lipinska-Kalita, K. E., D. M. Krol, R. J. Hemley, G. Mariotto, P. E. Kalita, and Y. Ohki, Synthesis and characterization of metal-dielectric composites with copper nanoparticles embedded in a glass matrix: a multi-technique approach, *J. Appl. Phys.*, **98**, 054301 (2005).
423. Gasparov, L. V., D. Arenas, K. J. Choi, G. Guentherodt, H. Berger, L. Forro, G. Margaritondo, V. V. Struzhkin, and R. J. Hemley, Magnetite: Raman study of the high-pressure and low-temperature effects, *MMM Conference*, **97**, 10A922 (2005).
424. Lipinska-Kalita, K. E., D. M. Krol, R. J. Hemley, G. Mariotto, P. E. Kalita, and Y. Ohki, Temperature effects on luminescence properties of Cr³⁺ ions in heterophased oxide glass based nanostructured media, *J. Appl. Phys.*, **98**, 054302 (2005).
425. Mora, A. E., J. W. Steeds, J. E. Butler, C. S. Yan, H. K. Mao and R. J. Hemley, Direct evidence of interaction between dislocations and point defects in diamond, *Phys. Stat. Sol. (a)*, **202**, R69-R71 (2005).
426. Wang, Z., L. L. Daemen, Y. Zhao, C. S. Zha, R. T. Downs, X. Wang, Z. L. Wang and R. J. Hemley, Morphology-tuned surface structure, mechanical stability, and transformation mechanism in wurtzite-type ZnS nanobelts, *Nature Materials*, **4**, 922-927 (2005).
427. Degtyareva, V. F., M. K. Sakharov, N. I. Novokhatskaya, O. Degtyareva, P. Dera, H. K. Mao and R. J. Hemley, Stability of Hume-Rothery phases in Cu-Zn alloys at pressures up to 50 GPa, *J. Phys. Cond. Matt.*, **17**, 7955-7962 (2005).
428. Mora, A. E., J. W. Steeds, J. E. Butler, C. S. Yan, H. K. Mao, R. J. Hemley and D. Fisher, New direct evidence of point defects interacting with dislocations and grain boundaries in diamond, *Phys. Stat. Sol.*, **202**, 2943-2494 (2005).

2006

429. Yoshimura, Y., S. T. Stewart, M. Somayazulu, H. K. Mao and R. J. Hemley, High-pressure x-ray diffraction and Raman spectroscopy of ice VIII, *J. Chem. Phys.*, **124**, 024502 (2006).

430. Ahart, M., A. Asthagiri, P. Dera, H. K. Mao, R. E. Cohen and R. J. Hemley, Single-domain electromechanical constants for $\text{Pb}(\text{Zn}_{1/3}\text{Nb}_{2/3})\text{O}_3$ -4.5% PbTiO_3 from micro-brillouin scattering, *Appl. Phys. Lett.* **88**, 042908 (2006).
431. Brown, G. E., G. Calas and R. J. Hemley, Role of user facilities in Earth sciences research, *Elements*, **2**, 23-30 (2006).
432. Hemley, R. J., Erskine Williamson, extreme conditions, and the birth of mineral physics, *Phys. Today*, **59**, 50-56 (2006).
433. Yoshimura, Y., H. K. Mao and R. J. Hemley, Direct transformation of ice VII' to low density amorphous ice, *Chem. Phys. Lett.*, **420**, 503-506 (2006).
434. Gregoryanz, E., C. Sanloup, R. Bini, J. Kreutz, H. J. Jodl, M. Somayazulu, H. K. Mao and R. J. Hemley, On the ϵ - ζ transition of nitrogen, *J. Chem. Phys.*, **124**, 116102 (2006).
435. Ho, S. S., C. S. Yan, Z. Liu, H. K. Mao and R. J. Hemley, Prospects for large single crystal CVD diamonds, *Industrial Diamond Review*, **66**, 28-32 (2006).
436. Young, A. F., C. Sanloup, E. Gregoryanz, S. Scandolo, R. J. Hemley and H. K. Mao, Synthesis of novel transition metal nitrides IrN_2 and OsN_2 , *Phys. Rev. Lett.*, **96**, 155501 (2006).
437. Mao, W. L., H. K. Mao, V. B. Prakapenka, J. Shu and R. J. Hemley, The effect of pressure on the structure and volume of ferromagnesian post-perovskite, *Geophys. Res. Lett.*, **33**, L12S02 (2006).
438. Struzhkin, V. V., H. K. Mao, J. F. Lin, R. J. Hemley, J. S. Tse, Y. Ma, M. Hu, and C. C. Kao, Valence band x-ray emission spectra of compressed germanium, *Phys. Rev. Lett.*, **96**, 137402 (2006).
439. Ahart, M., J. L. Yarger, K. M. Lantzky, S. Nakano, H. K. Mao and R. J. Hemley, High pressure Brillouin scattering of amorphous BeH_2 , *J. Chem. Phys.*, **124**, 14502 (2006).
440. Mao, H. K., J. Badro, R. J. Hemley and A. K. Singh, Strength, anisotropy, and preferred orientation of solid argon at high pressures, *J. Phys. Cond. Matt.*, **8**, S963-S968 (2006).
441. Chellappa, R. S., D. Chandra, S. A. Gramsch, R. J. Hemley, J. F. Lin and Y. Song, Pressure induced phase transformation in LiAlH_4 , *J. Phys. Chem. B*, **110**, 11088-11097 (2006).
442. Mao, W. L., H. K. Mao, W. Sturhahn, J. Zhao, V. B. Prakapenka, Y. Meng, Y. Fei and R. J. Hemley, Iron-rich post-perovskite and the origin of ultralow-velocity zones, *Science*, **312**, 564-565 (2006).
443. Hemley, R. J., A pressing matter, *Phys. World*, **19**, 26-30 (2006).
444. Dobrzhinetskaya, L. F., Z. Liu, P. Cartigny, J. Zhang, D. Tchkheta, R. J. Hemley and H. W. Green II, Synchrotron infrared and Raman spectroscopy of microdiamonds from Erzgebirge, Germany, *Earth Planet Sci. Lett.*, **248**, 325-334 (2006).
445. Degtyareva, V. F., O. Degtyareva, H. K. Mao and R. J. Hemley, High-pressure behavior of CdSb : compound decomposition, new phase formation and amorphization, *Phys. Rev. B*, **73**, 214108 (2006).
446. Militzer, B. and R. J. Hemley, Crystallography: Solid oxygen takes shape, *Nature*, **443**, 150-151 (2006).
447. Goncharov, A. F. and R. J. Hemley, Probing hydrogen-rich molecular systems at high pressures and temperatures, *Chem. Soc. Rev.*, **35**, 899-907 (2006).
448. Mao, W. L., H. K. Mao, Y. Meng, P. Eng, M. Y. Hu, P. Chow, Y. Q. Cai, J. Shu and R. J. Hemley, X-ray induced dissociation of H_2O and formation of an O_2 - H_2 alloy at high pressure, *Science*, **314**, 636-638 (2006).

449. Ahart, M., A. Asthagiri, R. E. Cohen, J. L. Yarger, H. K. Mao and R. J. Hemley, Brillouin spectroscopy of relaxor ferroelectrics and metal hydrides, *J. Mat. Sci. and Engineering A*, **442**, 519-522 (2006).
450. Klug, D. D., J. S. Tse, Z. Liu and R. J. Hemley, Hydrogen-bond dynamics and Fermi resonance in methane filled ice, *J. Chem. Phys.*, **125**, 154509 (2006).
451. Lipinska-Kalita, K. E., P. E. Kalita, D. M. Krol, R. J. Hemley, C. L. Gobin, and Y. Ohki, Spectroscopic properties of Cr³⁺ ions in nanocrystalline glass-ceramic composites, *J. Non-Crystalline Solids*, **352**, 524-527 (2006).

2007

452. Beck, P., A. F. Goncharov, V. V. Struzhkin, B. Militzer, H. K. Mao, and R. J. Hemley, Measurement of thermal diffusivity at high pressure using a transient heating technique, *Appl. Phys. Lett.*, **91**, 181914 (2007).
453. Dattlebaum, D. M., L. L. Stevens, E. B. Orler, M. Ahart, and R. J. Hemley, Brillouin-scattering determination of the acoustic properties of polymers at high pressure, in *Shock Compression of Condensed Matter -- 2007* (ed. M. L. Elert), 39-42 (American Institute of Physics, Melville, NY, 2007).
454. Mao, W. L., A. J. Campbell, V. B. Prakapenka, R. J. Hemley, and H. K. Mao, Effect of iron on the properties of post-perovskite silicate, in *Post-Perovskite: The Last Mantle Phase Transition* (ed. K. Hirose), 37-46 (American Geophysical Union, Washington, DC, 2007)
455. Chen, X. J., B. Liang, Z. Wu, C. Ulrich, C. T. Lin, V. V. Struzhkin, R. J. Hemley, H. K. Mao, and H. Q. Lin, Oxygen isotope effect in Bi₂Sr₂Ca_{n-1}Cu_nO_{2n+4+d} (n=1, 2, 3) Single Crystal, *Phys. Rev. Lett.*, **76**, 140502 (2007).
456. Gregoryanz, E., A. F. Goncharov, C. Sanloup, M. Somayazulu, H. K. Mao, and R. J. Hemley, High *P-T* behavior of nitrogen to 170 GPa, *J. Chem. Phys.*, **126**, 184505 (2007).
457. Santoro, M., E. Gregoryanz, H. K. Mao, and R. J. Hemley, Anomalous optical emission in hot dense oxygen, *Solid State Comm.*, **144**, 225-229 (2007).
458. Scott, H. P., Z. Liu, R. J. Hemley, and Q. Williams, High pressure infrared spectra of talc and lawsonite, *Am. Mineral.*, **92**, 1814-1820 (2007).
459. Struzhkin, V. V., B. Militzer, W. L. Mao, H. K. Mao, and R. J. Hemley, Hydrogen storage in molecular clathrates, *Chem. Rev.*, **107**, 4133-4151 (2007).
460. Yoshimura, Y., H. K. Mao, and R. J. Hemley, An in situ Raman spectroscopic study on the reversible transition between low-density and high-density amorphous ices at 135 K, *J. Phys.: Cond. Matt.*, **19**, 425214 (2007).
461. Yoshimura, Y., S. T. Stewart-Mukhopadhyay, H. K. Mao, and R. J. Hemley, In situ Raman spectroscopy of low temperature high pressure transformations of H₂O, *J. Chem. Phys.*, **126**, 174505 (2007).
462. Stevens, L. L., E. B. Orler, D. M. Dattelbaum, M. Ahart, and R. J. Hemley, A Brillouin-scattering determination of the acoustic properties and their pressure dependence for three polymeric elastomers, *J. Chem. Phys.*, **127**, 140906 (2007).
463. Hemley, R. J., V. V. Struzhkin, and R. E. Cohen, Measuring high-pressure electronic and magnetic properties, in *Treatise on Geophysics* (ed. G. D. Price), 293-337 (Elsevier, Amsterdam, 2007).

464. Zha, C. S., R. J. Hemley, S. A. Gramsch, H. K. Mao, and W. A. Bassett, Optical study of H₂O ice to 120 GPa: dielectric function, molecular polarizability, and equation of state, *J. Chem. Phys.*, **126**, 074506 (2007).
465. Somayazulu, M., S. A. Gramsch, H. K. Mao, and R. J. Hemley, High pressure-high temperature reactions in xenon-chlorine system, in *Materials Research at High Pressure* (eds. M. R. Manaa, Goncharov, A. F., Hemley, R. J. and Bini, R.), **987**, 127-132 (Materials Research Society, Warrendale, Pennsylvania, 2007).
466. Shu, J., W. L. Mao, R. J. Hemley, and H. K. Mao, Pressure-induced distortive phase transition in chromite-spinel at 29 GPa, in *Materials Research at High Pressure* (eds. M. R. Manaa, Goncharov, A. F., Hemley, R. J. and Bini, R.), **987**, 179-184 (Materials Research Society, Warrendale, Pennsylvania, 2007).
467. Okuchi, T., M. Takigawa, J. Shu, H. K. Mao, R. J. Hemley, and T. Yagi, Fast molecular transport in hydrogen hydrates by high- pressure diamond anvil cell NMR, *Phys. Rev. B*, **75**, 144104 (2007).
468. Mao, H. K. and R. J. Hemley, The high-pressure dimension in earth and planetary science, *Proc. Nat. Acad. Sci.*, **104**, 9114-9115 (2007).
469. Kaminskii, A. A., R. J. Hemley, J. Lai, C. S. Yan, H. K. Mao, V. G. Ralchenko, H. J. Eichler, and H. Rhee, High-order stimulated Raman scattering in CVD single crystal diamond, *Laser Phys. Lett.*, **4**, 350-353 (2007).
470. Degtyareva, O., V. V. Struzhkin, and R. J. Hemley, High-pressure Raman spectroscopy of antimony: As-type, incommensurate host-guest, and bcc phases, *Solid State Comm.*, **141**, 164-167 (2007).
471. Degtyareva, O., M. Martinez Canales, A. Bergara, X. J. Chen, V. V. Struzhkin, H. K. Mao, and R. J. Hemley, Crystal structure of SiH₄ at high pressure, *Phys. Rev. B*, **76**, 064123 (2007).
472. Degtyareva, O., E. R. Hernandez, J. Serrano, M. Somayazulu, H. K. Mao, E. Gregoryanz, and R. J. Hemley, Vibrational dynamics and stability of the high-pressure chain and ring phases in S and Se, *J. Chem. Phys.*, **126**, 084503 (2007).
473. Ciezak, J. A., T. A. Jenkins, Z. Liu, and R. J. Hemley, High-pressure vibrational spectroscopy of energetic materials: Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX), *J. Phys. Chem.*, **111**, 59-63 (2007).
474. Chen, X. J., V. V. Struzhkin, Z. G. Wu, H. Q. Lin, R. J. Hemley, and H. K. Mao, Unified picture of the oxygen isotope effect in cuprate superconductors, *Proc. Nat. Acad. Sci.*, **104**, 3732-3735 (2007).
475. Chellappa, R. S., D. Chandra, S. A. Gramsch, M. Somayazulu, and R. J. Hemley, Pressure-induced phase transformations in Li-based complex hydrides, in *Materials Research at High Pressure* (eds. M. R. Manaa, Goncharov, A. F., Hemley, R. J. and Bini, R.), **987**, 133-138 (Materials Research Society, Warrendale, Pennsylvania, 2007).
476. Caracas, R. and R. J. Hemley, New structures of dense nitrogen: pathways to the polymeric phase, *Chem. Phys. Lett.*, **442**, 65-70 (2007).
477. Ahart, M., A. Asthagiri, Z. G. Ye, P. Dera, H. K. Mao, R. E. Cohen, and R. J. Hemley, Brillouin scattering study of Pb(Mg_{1/3}Nb_{2/3})O₃, *Phys. Rev. B*, **75**, 144410 (2007).
478. Chen, X. J., V. V. Struzhkin, Z. G. Wu, R. J. Hemley, H. K. Mao, and H. Q. Lin, Phonon-mediated superconducting transitions in layered cuprate superconductors, *Phys. Rev. B* **75**, 134504 (2007).

479. Chen, X. J., V. V. Struzhkin, A. F. Goncharov, R. J. Hemley, and H. K. Mao, Oxygen isotope effect in a high-temperature superconductor under high pressure, *J. Phys.: Cond. Matt.* **19**, 425236 (2007).

2008

480. Ahart, M., M. Somayazulu, P. Dera, H. K. Mao, R. E. Cohen, R. J. Hemley, R. Yang, H. P. Liermann, and Z. Wu, Origin of morphotropic phase boundaries in ferroelectrics, *Nature*, **451**, 545-548 (2008).
481. Chen, X. J., V. V. Struzhkin, Y. Song, A. F. Goncharov, M. Ahart, Z. Liu, H. K. Mao, and R. J. Hemley, Pressure-induced metallization of solid silane, *Proc. Nat. Acad. Sci.*, **105**, 20-23 (2008).
482. Chen, X. J., J. L. Wang, V. V. Struzhkin, H. K. Mao, R. J. Hemley, and H. Q. Lin, Superconducting behavior in compressed solid SiH₄ with a layered structure, *Phys. Rev. Lett.*, **101**, 077002 (2008).
483. El Goresy, A., P. Dera, T. Sharp, C. T. Prewitt, M. Chen, L. S. Dubrovinsky, B. Wopenka, N. Boctor, and R. J. Hemley, Seiferite, a dense orthorhombic polymorph of silica from the Martian meteorites Shergotty and Zagami, *Eur. J. Mineral.*, **20**, 523-528 (2008).
484. Freiman, Y. A., I. N. Goncharenko, N. Tret'yak, A. Grechnev, J. S. Tse, D. Errandonea, H. K. Mao, and R. J. Hemley, Raman scattering and lattice distortion of hcp rare gas solids under pressure, *Phys. Rev. B*, **78**, 014301 (2008).
485. Goncharov, A. F., P. Beck, V. V. Struzhkin, R. J. Hemley, and J. C. Crowhurst, Laser heating diamond anvil cell studies of simple molecular systems at high pressures and temperatures, *J. Phys. Chem. Solids*, **69**, 2217-2222 (2008).
486. Goncharov, A. F., J. C. Crowhurst, V. V. Struzhkin, and R. J. Hemley, Triple point on the melting curve and polymorphism of nitrogen at high pressure, *Phys. Rev. Lett.*, **101**, 095502 (2008).
487. Liang, Q., C. S. Yan, Y. Meng, J. Lai, S. Krasnicki, T. Yu, H. Shu, H. K. Mao, and R. J. Hemley, Ultratough single crystal diamonds by MPCVD, *Proceedings of Intertech 2008*, (2008).
488. Lipinska-Kalita, K., O. A. Hemmers, P. E. Kalita, G. Mariotto, S. A. Gramsch, R. J. Hemley, and T. Hartmann, High-pressure structural integrity and structural transformations of glass-derived nanocomposites: A review, *J. Phys. Chem. Solids*, **69**, 2268-2273 (2008).
489. Liu, H., L. Wang, X. Xiao, F. De Carlo, J. Feng, H. K. Mao, and R. J. Hemley, Anomalous pressure-induced behavior of amorphous selenium from synchrotron x-ray diffraction and microtomography, *Proc. Nat. Acad. Sci.*, **105**, 13229-13234 (2008).
490. Mao, W. L., V. V. Struzhkin, A. Q. R. Baron, S. Tsutsui, C. E. Tommaseo, H. R. Wenk, M. Y. Hu, P. Chow, W. Sturhahn, J. Shu, R. J. Hemley, D. L. Heinz, and H. K. Mao, Experimental determination of the elasticity of iron at high pressure, *J. Geophys. Res.*, **113**, B09213 (2008).
491. Meng, Y., P. J. Eng, J. S. Tse, D. M. Shaw, M. Y. Hu, J. Shu, S. A. Gramsch, C. Kao, R. J. Hemley, and H. K. Mao, Inelastic x-ray scattering of dense solid oxygen: evidence for intermolecular bonding, *Proc. Nat. Acad. Sci.*, **33**, 11640-11644 (2008).
492. Meng, Y. F., C. S. Yan, J. Lai, S. Krasnicki, H. Shu, Q. Liang, H. K. Mao, and R. J. Hemley, Enhanced optical properties of chemical vapor deposited single crystal diamond by low-pressure/high-temperature annealing, *Proc. Nat. Acad. Sci.*, 17620-17625 (2008).

493. Somayazulu, M., J. Shu, C. S. Zha, A. F. Goncharov, O. Tschauner, H. K. Mao, and R. J. Hemley, In-situ high-pressure x-ray diffraction study of H₂O ice VII, *J. Chem. Phys.*, **128**, 064510 (2008).
494. Struzhkin, V. V., A. F. Goncharov, R. Caracas, H. K. Mao, and R. J. Hemley, Synchrotron infrared spectroscopy of the pressure induced insulator-metal transitions in glassy As₂S₃ and As₂Se₃, *Phys. Rev. B*, **77**, 165133 (2008).
495. Yoshimura, Y., H. K. Mao, and R. J. Hemley, In-situ Raman study of the pressure-induced bulk melting of hexagonal ice, *J. Phys.: Conf. Series*, **121**, 042004 (2008).
496. Zha, C. S., K. Mibe, W. A. Bassett, O. Tschauner, H. K. Mao, and R. J. Hemley, The P-V-T equation of state of platinum to 80 GPa and 1900 K using new internal resistive heating diamond-anvil cell techniques, *J. Appl. Phys.*, **103**, 054908 (2008).

2009

497. Ahart, M., A. Hushur, Y. Bing, Z. G. Ye, R. J. Hemley, and S. Kojima, Critical slowing down of relaxation dynamics near the Curie temperature in the relaxor Pb(Sc_{0.5}Nb_{0.5})O₃, *Appl. Phys. Lett.*, **94**, 142906 (2009).
498. Ahart, M., M. Somayazulu, Z. G. Ye, R. E. Cohen, H. K. Mao, and R. J. Hemley, High pressure Brillouin scattering of Pb(Mg_{1/3}Nb_{2/3})O₃, *Phys. Rev. B*, **79**, 132103 (2009).
499. Chellappa, R. S., M. Somayazulu, and R. J. Hemley, Rhenium reactivity with H₂O-O₂ mixtures at high pressures, *High Press. Res.*, **29**, 792-799 (2009).
500. Chellappa, R., M. Somayazulu, V. V. Struzhkin, T. Autrey, and R. J. Hemley, Pressure-induced complexation of NH₃BH₃-H₂, *J. Chem. Phys.*, **131**, 224515 (2009).
501. Feldman, J. L., J. K. Johnson, and R. J. Hemley, Vibron hopping and bond anharmonicity in hot dense hydrogen, *J. Chem. Phys.*, **130**, 054502 (2009).
502. Freiman, Y. A., S. M. Tretyak, A. Grechnev, A. F. Goncharov, J. S. Tse, D. Errandonea, H. K. Mao, and R. J. Hemley, Lattice distortion of hcp solid helium under pressure, *Phys. Rev. B*, **80**, 094112 (2009).
503. Goncharov, A. F., R. J. Hemley, and E. Gregoryanz, Comment on "The melting line of hydrogen at high pressures", *Phys. Rev. Lett.*, **102**, 149601 (2009).
504. Goncharov, A. F., J. A. Montoya, N. Subramanian, V. V. Struzhkin, A. I. Kolesnikov, M. Somayazulu, and R. J. Hemley, Laser heating in diamond anvil cells: Developments in pulsed and continuous techniques, *J. Synch. Radiation*, **16**, 769-772 (2009).
505. Hemley, R. J., G. W. Crabtree, and M. V. Buchanan, Energy challenges for materials in extreme environments, *Phys. Today*, **62**, 32-37 (2009).
506. Lazicki, A., A. F. Goncharov, V. V. Struzhkin, R. E. Cohen, Z. Liu, E. Gregoryanz, C. Guillaume, H. K. Mao, and R. J. Hemley, Anomalous optical and electronic properties of dense sodium, *Proc. Nat. Acad. Sci.*, **106**, 6525-6528 (2009).
507. Liang, Q., C. Y. Chin, J. Lai, C. S. Yan, Y. F. Meng, H. K. Mao, and R. J. Hemley, Enhanced growth of high quality single crystal diamond by MPCVD at high gas pressures, *Appl. Phys. Lett.*, **94**, 024103 (2009).
508. Liang, Q., C. S. Yan, Y. Meng, J. Lai, S. Krasnicki, H. K. Mao, and R. J. Hemley, Recent advances in high-growth rate single-crystal CVD diamond, *Diamond Rel. Mater.*, **18**, 698-703 (2009).

509. Liang, Q., C. S. Yan, Y. F. Meng, J. Lai, S. Krasnicki, H. K. Mao, and R. J. Hemley, Enhancing the mechanical properties of CVD single-crystal diamond, *J. Phys. Cond. Matt.*, **21**, 364215 (2009).
510. Ravindran, T. R., A. F. Goncharov, M. Somayazulu, and R. J. Hemley, Melting curve of oxygen at high pressure, in *Proceedings of the 54th DAE Solid State Physics Symposium* (eds. A. K. Rajarajan, Garg, A. B. and Kothiyal, G. P.), 181-182 (Board of Research in Nuclear Sciences, Mumbai, India, 2009).
511. Seagle, C. T., D. L. Heinz, Z. Liu, and R. J. Hemley, Synchrotron infrared reflectivity measurements of iron at high pressures, *Appl. Optics*, **48**, 545-552 (2009).
512. Sharma, A., G. D. Cody, and R. J. Hemley, In situ diamond-anvil cell observations of methanogenesis at high pressures and temperatures, *Energ. Fuel.*, **23**, 5571-5579 (2009).
513. Strobel, T. A., M. Somayazulu, and R. J. Hemley, Novel pressure-induced interactions in silane-hydrogen, *Phys. Rev. Lett.*, **103**, 065701 (2009).
514. Struzhkin, V. V., H. K. Mao, and R. J. Hemley, High-pressure synchrotron x-ray spectroscopy with diamond anvil cells, in *Perspectives in Materials Characterization* (eds. G. Amarendra, Raj, B. and Manghnani, M.), 151-178 (University Press (India), Hyderabad, India, 2009).
515. Toledano, P., H. Katzke, A. F. Goncharov, and R. J. Hemley, Symmetry breaking in dense solid hydrogen, *Phys. Rev. Lett.*, **103**, 105301 (2009).
516. Zha, C. S., S. Krasnicki, Y. F. Meng, C. S. Yan, J. Lai, Q. Liang, H. K. Mao, and R. J. Hemley, Composite chemical vapor deposition diamond anvils for highpressure/high-temperature experiments, *High Press. Res.*, **29**, 317-324 (2009).
517. Zhang, C., W. Yi, L. L. Sun, X. J. Chen, R. J. Hemley, H. K. Mao, W. Lu, X. L. Dong, L. G. Bai, J. Liu, A. F. Moreira Dos Santos, J. J. Molaison, C. A. Tulk, G. F. Chen, N. L. Wang, and Z. X. Zhao, Pressure-induced lattice collapse in Fe_{1.05}Te, *Phys. Rev. B*, **80**, 144519 (2009).
518. Yu, S., Z. Liu, W. Q. Han, and R. J. Hemley, Synchrotron infrared and x-ray studies of bornon nitrides nanotubes under high pressure, in *Proceedings of the Joing AIRAPT-22 and HPCJ-50 International Conference on High Pressure Science and Technology 41* (Tokyo, Japan, 2009).
519. Beck, P., A. F. Goncharov, J. A. Montoya, V. V. Struzhkin, B. Militzer, R. J. Hemley, and H. K. Mao, Response to "Comment on 'Measurements of the thermal diffusivities at high-pressure using a transient heating technique'" [*Appl. Phys. Lett.* **95**, 096101 (2007)] *Appl. Phys. Lett.* **95**, 096102 (2009).
520. Oganov, A. R., V. L. Solozhenko, O. O. Kurakevych, C. Gatti, Y. Ma, J. Chen, Z. Liu, R. J. Hemley, Comment on "Superhard semiconducting optically transparent high pressure phase of boron" [*Phys. Rev. Lett.* **102**, 185501 (2009)], arXiv:0908.2126.

2010

521. Ahart, M., H. K. Mao, R. E. Cohen, R. J. Hemley, G. Samara, Y. Bing, Z. G. Ye, and S. Kojima, Pressure effects on relaxor ferroelectricity in disordered Pb(Sc_{1/2}Nb_{1/2})O₃, *J. Appl. Phys.*, **107**, 074110 (2010).
522. Chellappa, R. S., T. Autrey, M. Somayazulu, V. V. Struzhkin, and R. J. Hemley, High pressure interactions with polyaminoborane and polyiminoborane, *Chem. Phys. Chem.*, **11**, 93-96 (2010).

523. Emmons, E. D., V. K. Kamisetty, J. C. Fallas, W. M. Chien, A. M. Covington, R. S. Chellappa, S. A. Gramsch, R. J. Hemley, and D. Chandra, High-pressure Raman spectroscopy of tris(hydroxymethyl)aminomethane, *J. Phys. Chem. B*, **144**, 5649-5656 (2010).
524. Ganesh, P., E. Cockayne, M. Ahart, R. E. Cohen, B. Burton, R. J. Hemley, Y. Ren, W. Yang, and Z. G. Ye, Origin of diffuse scattering in relaxor ferroelectrics, *Phys. Rev. B*, **81**, 144102 (2010).
525. Lazicki, A., Y. Fei, and R. J. Hemley, High pressure differential thermal analysis measurement of the melting curve of lithium, *Solid State Comm.*, **150**, 625-627 (2010).
526. Somayazulu, M., P. Dera, A. F. Goncharov, S. A. Gramsch, H. P. Liermann, W. Yang, Z. Liu, H. K. Mao, and R. J. Hemley, Pressure-induced bonding and compound formation in xenon-hydrogen solids, *Nature Chem.*, **2**, 50-53 (2010).
527. Subramanian, N., A. F. Goncharov, M. Somayazulu, and R. J. Hemley, Raman spectroscopy of hydrogen confined under extreme conditions, *J. Phys.: Conf. Series*, **215**, 012057 (2010).
528. Tang, Y., A. F. Goncharov, V. V. Struzhkin, R. J. Hemley, and M. Ouyang, Spin of semiconductor quantum dots under pressure, *Nano Lett.*, **10**, 358-362 (2010).
529. Wang, L., Y. Ding, W. Yang, W. Liu, Z. Cai, J. Kung, J. Shu, R. J. Hemley, and H. K. Mao, Nanoprobe measurements of materials at megabar pressures, *Proc. Nat. Acad. Sci.*, **107**, 6140-6145 (2010).
530. Yamanaka, T., W. L. Mao, R. J. Hemley, and G. Shen, New structure and spin state of iron-rich (Mg,Fe)SiO₃ post-perovskite, *J. Phys.: Conf. Series*, **215**, 012100 (2010).
531. Yoshimura, Y., H. K. Mao, and R. J. Hemley, In situ Raman and optical microscopy of relaxation behavior of amorphous ices under pressure, *J. Raman Spectrosc.*, **41**, 678-683 (2010).
532. Zhang, C., X. J. Chen, Y. L. Li, V. V. Struzhkin, R. J. Hemley, H. K. Mao, R. Q. Zhang, and H. Q. Lin, Superconductivity in hydrogen-rich material: GeH₄, *J. Supercond. Nov. Magn.*, **23**, 717-719 (2010).
533. Wang, L., W. Yang, Y. Ding, Y. Ren, S. Xiao, B. Liu, S. V. Sinogeikin, Y. Meng, D. J. Gosztola, G. Shen, R. J. Hemley, W. L. Mao, and H. K. Mao, Size-dependent amorphization of nanoscale Y₂O₃ at high pressure, *Phys. Rev. Lett.*, **105**, 095701 (2010).
534. Chen, X. J., V. V. Struzhkin, Y. Yu, C. T. Lin, R. J. Hemley, and H. K. Mao, Enhancement of superconductivity by pressure-driven phase competition, *Nature*, **466**, 950-953 (2010).
535. McCubbin, F. M., A. Steele, E. Hauri, H. Nekvasil, S. Yamashita, and R. J. Hemley, Nominally hydrous magmatism on the moon, *Proc. Nat. Acad. Sci.*, **107**, 11223-11228 (2010).
536. Subramanian, N., V. V. Struzhkin, A. F. Goncharov, and R. J. Hemley, A virtual experiment control and data acquisition system for in situ laser heated diamond anvil cell Raman spectroscopy, *Rev. Sci. Instrum.*, **81**, 093906 (2010).
537. Fallas, J. C., E. D. Emmons, W. M. Chien, D. Chandra, V. K. Kamisetty, A. M. Covington, R. Chellappa, H. Hagemann, S. A. Gramsch, and R. J. Hemley, Raman spectroscopy measurements of the pressure-temperature behavior of LiAlH₄, *J. Phys. Chem. C*, **114**, 11991-11997 (2010).
538. Shen, G., L. Wang, R. Ferry, H. K. Mao, and R. J. Hemley, A portable laser heating microscope for high pressure research, *J. Phys.: Conf. Series*, **215**, 012191 (2010).
539. Jacobsen, S. D., Z. Liu, T. B. Ballaran, E. F. Littlefield, L. Ehm, and R. J. Hemley, Effect of H₂O on upper mantle phase transitions in MgSiO₃: Is the depth of the seismic X-

- discontinuity an indicator of mantle water content? *Phys. Earth Planet. Inter.*, **183**, 234-244 (2010).
540. Lazicki, A., R. J. Hemley, W. E. Pickett, and C. S. Yoo, Structural study of LiB to 70 GPa, *Phys. Rev. B*, **82**, 180102 (2010).
541. Mao, H. K., E. L. Shirley, Y. Ding, P. Eng, Y. Q. Cai, P. Chow, Y. Xiao, J. Shu, R. J. Hemley, C. Kao, and W. L. Mao, Electron structure of crystalline ^4He at high pressures, *Phys. Rev. Lett.*, **105**, 186404 (2010).
542. Strobel, T. A., X. J. Chen, M. Somayazulu, and R. J. Hemley, Vibrational dynamics, intermolecular interactions, and compound formation in $\text{GeH}_4 - \text{H}_2$ under pressure, *J. Chem. Phys.*, **133**, 164512 (2010).
543. Hemley, R. J., Percy W. Bridgman's second century, *High Press. Res.*, **4**, 581-619 (2010).
544. Ciezak, J. A., T. A. Jenkins, and R. J. Hemley, Optical and Raman microspectroscopy of nitrogen and hydrogen mixtures at high pressure, in *Proceedings of the American Physical Society Topical Group on Shock Compression of Condensed Matter* (eds. M. L. Ellert, M. D. Furnish, W. W. Anderson, W. G. Proud, and W. T. Butler), **1195**, 1291 (2010).

2011

545. Yoshimura, Y., S. T. Stewart, M. Somayazulu, H. K. Mao, and R. J. Hemley, Convergent Raman features in high density amorphous ice, ice VII, and ice VIII under pressure, *J. Chem. Phys. B*, **115**, 3756-3760 (2011).
546. Shu, J., X. J. Chen, I. M. Chou, W. Yang, J. Hu, R. J. Hemley, and H. K. Mao, Structural stability of methane hydrate at high pressures, *Geosci. Frontiers*, **21**, 93-100 (2011).
547. Ahart, M., M. Somayazulu, S. A. Gramsch, R. Boehler, H. K. Mao, and R. J. Hemley, Brillouin scattering of H_2O -ice to megabar pressures, *J. Chem. Phys.*, **134**, 124517 (2011).
548. Subramanian, N., A. F. Goncharov, V. V. Struzhkin, M. Somayazulu, and R. J. Hemley, Bonding changes in hot fluid hydrogen at megabar pressures, *Proc. Nat. Acad. Sci.*, **108**, 6014-6019 (2011).
549. Goncharov, A. F., R. J. Hemley, and H. K. Mao, Vibron frequencies of solid H_2 and D_2 to 200 GPa and implications for the P-T phase diagram, *J. Chem. Phys.*, **134**, 174501 (2011).
550. Griffin, P. L., A. Kish, A. Steele, and R. J. Hemley, Differential high-pressure survival in stationary phase *Escherichia coli* MG1655, *High Press. Res.*, **31**, 325-333 (2011).
551. Lin, Z. J., J. Z. Zhang, B. S. Li, L. P. Wang, H. K. Mao, R. J. Hemley, and Y. Zhao, Superhard diamond/tungsten carbide nanocomposites, *Appl. Phys. Lett.*, **98**, 121914 (2011).
552. Strobel, T. A., M. Somayazulu, and R. J. Hemley, Phase behavior of $\text{H}_2 + \text{H}_2\text{O}$ at high pressures and low temperature, *J. Phys. Chem.*, **115**, 4898-4903 (2011).
553. Strobel, T. A., A. F. Goncharov, C. T. Seagle, Z. Liu, M. Somayazulu, V. V. Struzhkin, and R. J. Hemley, High pressure study of silane to 150 GPa, *Phys. Rev. B*, **83**, 144102 (2011).
554. Kyono, A., M. Ahart, T. Yamanaka, S. A. Gramsch, H. K. Mao, and R. J. Hemley, High-pressure Raman spectroscopic studies of ulvöspinel Fe_2TiO_4 , *Am. Mineral.*, **96**, 1193-1198 (2011).
555. Goncharov, A. F., N. Subramanian, T. R. Ravindran, M. Somayazulu, V. Prakapenka, and R. J. Hemley, Polymorphism of dense, hot oxygen, *J. Chem. Phys.* **135**, 084512 (2011).
556. Chen, P. N., C. S. Zha, X. J. Chen, J. Shu, R. J. Hemley, and H. K. Mao, Raman study of phase transition in compressed methane using moissanite anvil cells, *Phys. Rev. B* **84**, 104110 (2011).

557. Litasov, K. D., A. F. Goncharov, and R. J. Hemley, Crossover from melting to dissociation of CO₂ under pressure: Implications for the lower mantle, *Earth Planet. Sci. Lett.* **309**, 318-323 (2011).
558. Freiman, Y. A., S. M. Tretyak, A. F. Goncharov, H. K. Mao, and R. J. Hemley, Molecular rotation in ρ -H₂, o-D₂, and HD in phase I under pressure, *J. Low Temp. Phys.* **37**, 1302-1306 (2011).
559. Dalton, D. A., M. Somayazulu, A. F. Goncharov, and R. J. Hemley, Static compression of tetramethylammonium borohydride (TMAB), *J. Phys. Chem. A*, **115**, 11033-11038 (2011).
560. Strobel, T. A., P. Ganesh, M. Somayazulu, P. R. C. Kent, and R. J. Hemley, Novel cooperative interactions and structural ordering in H₂S-H₂, *Phys. Rev. Lett.* **107**, 255503 (2011).
561. Ahart, M., R. E. Cohen, R. J. Hemley, S. V. Sinogeikin, O. Shebanova, D. Ikuta, and Z. G. Ye, Pressure-composition phase diagram of the Pb(Mg_{1/3}Nb_{2/3})O₃-PbTiO₃ solid solutions, *Proceedings of The 20th IEEE International Symposium on Applications of Ferroelectrics*, 36-39 (2011).
562. Hemawan, K. W., C. S. Yan, Q. Liang, J. Lai, Y. Meng, S. Krasnicki, H. K. Mao, and R. J. Hemley, Hot spot formation in microwave plasma CVD diamond synthesis, *IEEE Trans. Plasma Sci.* **39**, 2790-2791 (2011).

2012

563. Hemley, R. J., Dense Hydrogen in *High Pressure Physics* (ed. J. Loveday), CRC Press, Boca Raton, FL, 2012, pp. 301-319.
564. Meng, Y., C. S. Yan, S. Krasnicki, Q. Liang, J. Lai, H. Shu, T. Yu, A. S. Steele, H. K. Mao and R. J. Hemley, High optical quality multicarat single crystal diamond produced by chemical vapor deposition, *Phys. Stat. Sol. (a)*. **209**, 101-104 (2012).
565. Kyono, A., S. A. Gramsch, T. Yamanaka, D. Ikuta, M. Ahart, B. O. Mysen, H. K. Mao, and R. J. Hemley, The influence of the Jahn-Teller effect at Fe²⁺ on the structure of chromite at high pressure, *Phys. Chem. Minerals* **39**, 131-141 (2012).
566. Hazen, R. M., R. J. Hemley, and A. J. Mangum, Carbon in Earth's interior: Storage, cycling, and life, *Eos*, **93**, 17-18 (2012).
567. Yamanaka, T., K. Hirose, W. L. Mao, Y. Meng, P. Ganesh, L. Shulenburger, G. Shen, and R. J. Hemley, Crystal structures of (Mg, Fe)SiO₃ post-perovskite, *Proc. Nat. Acad. Sci.* **109**, 1035-1040 (2012).
568. Ding, Y., Z. Cai, J. Chang, R. J. Hemley, W. L. Mao, and H. K. Mao, Nanoscale diffraction imaging of the high-pressure ferroic transition in FeO, *Appl. Phys. Lett.* **100**, 041903 (2012).
569. Kish, A., P. L. Griffin, K. L. Rogers, M. L. Fogel, R. J. Hemley, and A. Steele, Cellular adaptations enabling high-pressure tolerance in *Halobacterium salinarum* NRC-1 and other non-piezophilic prokaryotes, *Extremophiles* **16**, 355-361 (2012).
570. Lazicki, A., P. Loubeyre, F. Occelli, R. J. Hemley, and M. Mezouar, Static compression of LiH to 250 GPa, *Phys. Rev. B* **85**, 054103 (2012).
571. Wang, S., Y. F. Meng, N. Ando, M. Tate, S. Krasnicki, C. S. Yan, Q. Liang, J. Lai, H. K. Mao, S. M. Gruner, and R. J. Hemley, Single-crystal CVD diamonds as small-angle x-ray scattering windows for high pressure research, *J. Appl. Cryst.* **45**, 453-457 (2012).
572. Irifune, T. and R. J. Hemley, New diamond windows into the Earth, *Eos* **45**, 453-457 (2012).

573. Zha, C. S., Z. Liu, and R. J. Hemley, Synchrotron infrared measurements of dense hydrogen to 360 GPa, *Phys. Rev. Lett.* **108**, 146402 (2012).
574. Benjamin, A. S., M. Ahart, S. A. Gramsch, L. L. Stevens, E. B. Orler, D. M. Dattelbaum, and R. J. Hemley, Acoustic properties of Kel F-800 copolymer up to 85 GPa, *J. Chem. Phys.* **137**, 014514 (2012).
575. Stevens, L. L., D. M. Dattelbaum, M. Ahart, and R. J. Hemley, High-pressure elastic properties of a fluorinated copolymer: Poly(chlorotrifluoroethylene-co-vinylidene fluoride) (Kel-F 800), *J. Appl. Phys.* **112**, 023523 (2012).
576. Freiman, Y. A., A. Grechnev, S. M. Tretyak, A. F. Goncharov, and R. J. Hemley, Equation of state and Raman-active E_{2g} lattice phonon in phases I, II, and III of solid hydrogen and deuterium, *Phys. Rev. B* **86**, 014111 (2012).
577. Singh, A. K., J. Hu, J. Shu, H. K. Mao, and R. J. Hemley, Strength of rhenium from x-ray diffraction experiments under nonhydrostatic compression to 250 GPa, *J. Phys.: Conf. Series* **377**, 012008 (2012).
578. Hemley, R. J., Dense hydrogen, in *High-Pressure Physics* (ed. J. Loveday), 301-323 (CRC Press, Boca Raton, FL, 2012).
579. Yamanaka, T., M. Ahart, Y. Nakamoto, Z. G. Ye, H. K. Mao, and R. J. Hemley, Anharmonic atom vibrations in relaxor ferroelectric $Pb(Mg_{1/3}Nb_{2/3})O_3$ under pressure, *Phys. Rev. B* **86**, 174108 (2012).
580. Ahart, M., R. E. Cohen, R. J. Hemley, S. Sinogeikin, O. Shebanova, D. Ikuta, and Z. G. Ye, Pressure-dependence of the monoclinic phase in the $Pb(Mg^{1/3}Nb_{2/3})O_3$ - $PbTiO_3$ solid solutions, *Phys. Rev. B* **86**, 224111 (2012).

2013

581. Freiman, Y. A., A. Grechnev, S. M. Tretyak, A. F. Goncharov, and R. J. Hemley, Sound velocities in solid hydrogen under pressure, *Low Temp. Phys.* **39**, 423-426 (2013).
582. Rotundu, C. R., V. V. Struzhkin, M. S. Somayazulu, S. V. Sinogeikin, R. J. Hemley, and R. L. Greene, High-pressure effects on single crystals of electron-doped $Pr_{2-x}Ce_xCuO_4$, *Phys. Rev. B* **87**, 024506 (2013).
583. Oganov, A. R., R. J. Hemley, R. M. Hazen, and A. P. Jones, Chapter 3: Structure, bonding, and mineralogy of carbon at extreme conditions, in *Carbon in Earth: Reviews in Mineralogy and Geochemistry* (eds. R. M. Hazen, A. P. Jones, A. P. and J. A. Baross), **75**, 47-77 (2013).
584. Loubeyre, L., M. Ahart, S. A. Gramsch, and R. J. Hemley, Density dependence of dynamical heterogeneity in fluid methanol, *J. Chem. Phys.* **138**, 174507 (2013).
585. Lyubutin, I. S., V. V. Struzhkin, A. A. Mironovich, A. G. Gavriliuk, P. G. Naumov, J. F. Lin, S. G. Ovchinnikov, S. V. Sinogeikin, P. Chow, Y. Xiao, and R. J. Hemley, Quantum critical point and spin fluctuations in lower-mantle ferropericlase, *Proc. Nat. Acad. Sci.* **110**, 7142-7147 (2013).
586. Zha, C. S., Z. Liu, M. Ahart, R. Boehler, and R. J. Hemley, High-pressure measurements of the solid phase IV of hydrogen using synchrotron infrared spectroscopy, *Phys. Rev. Lett.* **110**, 217402 (2013).
587. Rotundu, C. R., T. Cuk, R. L. Greene, Z. X. Shen, R. J. Hemley, and V. V. Struzhkin, High-pressure resistivity apparatus for quasi-hydrostatic compression experiments, *Rev. Sci. Instrum.* **8/4**, 063903 (2013).

588. Naumov, I. I., R. E. Cohen, and R. J. Hemley, Graphene physics and insulator-metal transition in compressed hydrogen, *Phys. Rev. B* **88**, 045125 (2013).
589. Liang, Q., Y. F. Meng, C. S. Yan, S. Krasnicki, J. Lai, K. W. Hemawan, H. Shu, D. Popov, T. Yu, W. Yang, H. K. Mao, and R. J. Hemley, Developments in synthesis, characterizations, and applications of large, high-quality CVD single crystal diamond, *J. Superhard Mater.* **35**, 195-213 (2013).
590. Ahart, M., C. DeVreugd, D. D. Viehland, P. M. Gehring, and R. J. Hemley, X-ray diffraction study of the pressure-induced bcc-to-hcp phase transition in highly magnetostrictive Fe_{0.81}Ga_{0.19} alloy, *Phys. Rev. B* **88**, 184102 (2013).
591. Freiman, Y. A., A. Grechnev, S. M. Tretyak, A. F. Goncharov, C. S. Zha, and R. J. Hemley, Sound velocities of hexagonal close-packed H₂ under pressure, *Phys. Rev. B* **88**, 214501 (2013).
592. Guthrie, M., R. Boehler, C. A. Tulk, A. M. dos Santos, J. J. Molaison, K. Li, and R. J. Hemley, Neutron diffraction observations of interstitial protons in dense ice, *Proc. Nat. Acad. Sci.* **110**, 10552-10556 (2013).
593. Cohen, R. E., I. Naumov, and R. J. Hemley, Optical evidence and mechanism of hydrogen metallization, *Proc. Nat. Acad. Sci.* **110**, 13757-13762 (2013).

2014

594. Doherty, M. W., V. V. Struzhkin, D. A. Simpson, L. P. McGuinness, Y. Meng, A. Stacey, T. J. Karle, R. J. Hemley, N. B. Manson, L. C. L. Hollenberg, and S. Prawer, Electronic properties and metrology of the diamond NV⁻ center under pressure, *Phys. Rev. Lett.* **112**, 047601 (2014).
595. Potter, R. G., M. Somayaulu, G. D. Cody, and R. J. Hemley, High pressure equilibria of dimethylamine borane, dihydridobis(dimethylamine)boron(III) tetrahydridoborate(III), and hydrogen, *J. Phys. Chem. C* **118**, 7280-7287 (2014).
596. Potter, R., M. Somayazulu, G. D. Cody, and R. J. Hemley, In-situ Raman spectroscopy and synchrotron x-ray diffraction studies on NNNN-tetramethylcyclotriborazane at high pressures, *J. Phys. Chem. C* **118**, 9871-9879 (2014).
597. Zha, C. S., R. E. Cohen, H. K. Mao, and R. J. Hemley, Raman measurements of phase transitions in dense solid hydrogen and deuterium to 325 GPa, *Proc. Nat. Acad. Sci.* **111**, 4792-4797 (2014).
598. Freiman, Y. A., S. M. Tretyak, A. Grechnev, A. F. Goncharov, and R. J. Hemley, Crystal field phenomena in hexagonal close-packed H₂ and D₂ at high pressures, *Phys. Rev. B* **90**, 024501 (2014).
599. Liang, Q., C. S. Yan, J. Lai, Y. F. Meng, S. Krasnicki, H. Shu, H. K. Mao, and R. J. Hemley, Large area single crystal diamond synthesis by 915 MHz microwave plasma-assisted chemical vapor deposition, *Cryst. Growth Design* **14**, 3234-3238 (2014).
600. Ahart, M., S. Kojima, Y. Yasuda, and R. J. Hemley, Successive pressure-induced structural transitions in relaxor lead indium niobate, *Ferroelectrics* **467**, 138-145 (2014).
601. Ahart, M., A. Karandikar, S. A. Gramsch, R. Boehler, and R. J. Hemley, Brillouin scattering measurements of H₂O melting to 30 GPa, *High Press. Res.* **34**, 327-336 (2014).
602. Naumov, I. I. and R. J. Hemley, Aromaticity, closed-shell effects, and metallization of hydrogen, *Accs. Chem. Res.* **47**, 3551-3559 (2014).

2015

603. Somayazulu, M., P. Dera, J. Smith, and R. J. Hemley, Structure and stability of solid $\text{Xe}(\text{H}_2)_n$, *J. Chem. Phys.* **142**, 104503 (2015).
604. Hemley, R. J., V. V. Struzhkin, R. E. Cohen, and G. Shen, Measuring high-pressure electronic and magnetic properties, in *Treatise on Geophysics, 2nd ed.* (ed. G. Schubert), **2**, 313-349 (Elsevier, Amsterdam, 2015).
605. Naumov, I. I. and R. J. Hemley, Origin of transition between metallic and insulating states in simple metals, *Phys. Rev. Lett.* **114**, 156403 (2015).
606. Hemawan, K. W. and R. J. Hemley, Optical emission diagnostics of microwave plasma CVD single crystal diamond synthesis, *JVST A* **33**, 061302 (2015).
607. Muramatsu, T., W. K. Wanene, M. Somayazulu, E. Vinitsky, D. Chandra, T. A. Strobel, V. V. Struzhkin, and R. J. Hemley, Metallization and superconductivity in the hydrogen-rich ionic salt BaReH_9 , *J. Phys. Chem C* **119**, 18007-18013 (2015)
608. Naumov, I. I., R. J. Hemley, R. Hoffmann, and N. W. Ashcroft, Chemical bonding in hydrogen and lithium under pressure, *J. Chem. Phys.* **143**, 064702 (2015).
609. Caracas, R. and R. J. Hemley, Ferroelectric dense ice, *J. Chem. Phys.* **142**, 134501 (2015).
610. Strzheimchny, M. A. and R. J. Hemley, Effects of rotational states on the c/a ratio in the solid hydrogens, *Phys. Rev. B* **91**, 144102 (2015).
611. Hemawan, K. W., H. Gou, and R. J. Hemley, Diamond synthesis at atmospheric pressure by microwave capillary plasma chemical vapor deposition, *Appl. Phys. Lett.* **107**, 181901 (2015).
612. Stagno, V., L. Bindi, C. Park, S. N. Tkachev, V. B. Prakapenka, H. K. Mao, R. J. Hemley, P. J. Steinhardt, and Y. Fei, Quasicrystals at extreme conditions: The role of pressure in stabilizing icosahedral $\text{Al}_{63}\text{Cu}_{24}\text{Fe}_{13}$ at high temperature, *Am. Mineral.* **100**, 2412-2418 (2015).
613. Yamanaka, T., A. Kyono, Y. Nakamoto, S. Kharlamova, V. V. Struzhkin, S. A. Gramsch, H. K. Mao, and R. J. Hemley, New structure of high-pressure body-centered orthorhombic Fe_2SiO_4 , *Am. Mineral.* **100**, 1736-1717 (2015).
614. Ahart, M., M. Somayazulu, S. Kojima, Y. Yasuda, S. Prosandeev, and R. J. Hemley, Structural transitions in $\text{Pb}(\text{In}_{1/2}\text{Nb}_{1/2})\text{O}_3$ under pressure, *J. Adv. Dielect.* **5**, 155033 (2015).

2016

615. Yamanaka, T., Y. Nakamoto, F. Takei, M. Ahart, H. K. Mao, and R. J. Hemley, Pressure-induced ferroelectric to paraelectric transition in LiTaO_3 and $(\text{Li},\text{Mg})\text{TaO}_3$, *J. Appl. Phys.* **119**, 075902 (2016)
616. Lu, S., H. Liu, I. I. Naumov, S. Meng, Y. Li, J. S. Tse, B. Yang, and R. J. Hemley, Superconductivity in dense carbon-based materials, *Phys. Rev. B* **93**, 104509 (2016).
617. Satapathy, S., M. Ahart, D. Dandekar, R. J. Hemley, B. Schuster, and P. Khoma, Single-crystal elastic properties of aluminum oxynitride (AlON) from Brillouin scattering, *J. Am. Ceram. Soc.* **99**, 1383-1389 (2016).
618. Wilfong, B., M. Ahart, S. A. Gramsch, C. Stock, X. Li, H. Luo, and R. J. Hemley, High P-T Raman study of transitions in relaxor multiferroic $\text{Pb}(\text{Fe}_{0.5}\text{Nb}_{0.5})\text{O}_3$, *J. Raman Spectrosc.*, **47**, 227-232 (2016).

619. Huang, Q. H., K. N. Tran, J. M. Rodgers, D. H. Bartlett, R. J. Hemley, and T. Ichiye, A molecular perspective on the limits of life: Enzymes under pressure, *Cond. Matt. Phys.* **19**, 22801 (2016).
620. Muramatsu, T., L. V. Gasparov, H. Berger, R. J. Hemley, and V. V. Struzhkin, Electrical resistance of single-crystal magnetite (Fe_3O_4) under quasi-hydrostatic pressures up to 100 GPa, *J. Appl. Phys.* **119**, 135903 (2016).
621. Hemawan, K. W., D. W. Keefer, J. V. Badding, and R. J. Hemley, Generation of microwave capillary argon plasmas at atmospheric pressure, *IEEE Trans. Plasma Sci.* **44**, 2603-2607 (2016).
622. Feng, B., V. I. Levitas, and R. J. Hemley, Large elastoplasticity under static megabar pressures: formulation and application to compression of samples in diamond anvil cells, *Int. J. Plasticity* **84**, 33-57 (2016).
623. Strobel, T. A., M. Somayazulu, S. V. Sinogeikin, P. Dera, and R. J. Hemley, Hydrogen-stuffed, quartz-like water ice, *J. Am. Chem. Soc.* **138**, 13786-13789 (2016).
624. Vinitzky, E. A., T. Muramatsu, M. Somayazulu, W. K. Wanene, Z. Liu, D. Chandra, and R. J. Hemley, Structural, vibrational, and electronic properties of BaReH_9 under pressure, *J. Phys.: Cond. Matt.* **28**, 5057001 (2016).
625. Naumov, I. I. and R. J. Hemley, Topological surface states in dense solid hydrogen, *Phys. Rev. Lett.* **117**, 206403 (2016).
626. Liu, H., I. I. Naumov, and R. J. Hemley, Dense hydrocarbon structures at megabar pressures, *J. Phys. Chem. Lett.* **7**, 4281-4222 (2016).
627. Hemawan, K. W. and R. J. Hemley, Microwave plasmas: Single crystal diamond synthesis, in *Encyclopedia of Plasma Technology*, edited by J. L. Shohet (CRC Press, Taylor and Francis, 2016), pp. 806-818.

2017

628. Huang, Q., J. M. Rodgers, R. J. Hemley, and T. Ichiye, Extreme biophysics: Enzymes under pressure, *J. Comput. Chem.* **38**, 1174-1182 (2017).
629. Miao, M., J. Botana, R. Hoffmann, I. I. Naumov, and R. J. Hemley, Quasimolecules in compressed lithium, *Angew. Chem.* **56**, 972-975 (2017).
630. Yim, W. L., H. Shi, Y. Liang, R. J. Hemley, and J. S. Tse, Band gaps and effective oscillator models for solid hydrogen and H_2O ice at high pressure, in *Correlations in Condensed Matter under Extreme Conditions* (eds. G. G. N. Angilella and A. La Magna), 107-126 (World Scientific, 2017).
631. Liu, H., I. I. Naumov, R. Hoffmann, N. W. Ashcroft, and R. J. Hemley, Potential high- T_c superconducting lanthanum and yttrium hydrides at high pressure, *Proc. Natl. Acad. Sci.*, **114**, 6990-6995 (2017).
632. Vadapoo, R., M. Ahart, M. Somayazulu, N. Holtgrewe, Y. Meng, Z. Konôpková, R. J. Hemley, and R. E. Cohen, Synthesis of a polar ordered oxynitride perovskite, *Phys. Rev B.* **95**, 214120 (2017).
633. Brownsberger, K., M. Ahart, M. Somayazulu, C. Park, S. A. Gramsch, and R. J. Hemley, X-ray diffraction, lattice structure, and equation of state of PdH_x and PdD_x to megabar pressures, *J. Phys. Chem. B* **121**, 27327-27331 (2017).
634. Ahart, M., D. Aihaiti, R. J. Hemley, and S. Kojima, Pressure dependence of the Boson peak of glassy glycerol, *J. Phys. Chem. C* **119**, 6667-6672 (2017).

635. Zha, C. S., H. Liu, J. S. Tse, and R. J. Hemley, Melting and high P - T transitions of hydrogen to 300 GPa, *Phys. Rev. Lett.* **119**, 075302 (2017).
636. Rodgers, J. M., R. J. Hemley, and T. Ichiye, Quasiharmonic analysis of protein energy landscapes from pressure-temperature molecular dynamics simulations, *J. Chem. Phys.* **147**, 125103 (2017).
637. Naumov, I. I. and R. J. Hemley, Metallic surface states in elemental electrides, *Phys. Rev. B* **96**, 035421 (2017).
638. Ransom, T. C., M. Ahart, R. J. Hemley, and C. M. Roland, Vitrification and density scaling of polyurea at pressures up to 6 GPa, *Macromolecules* **50**, 8274-8278 (2017).

2018

639. Geballe, Z. M., H. Liu, A. K. Mishra, M. Ahart, M. Somayazulu, Y. Meng, M. Baldini, and R. J. Hemley, Synthesis and stability of lanthanum superhydrides, *Angew. Chem. Int. Ed.* **57**, 688-692 (2018).
640. Basu, A., M. Ahart, N. Holtgrewe, C. Lin, and R. J. Hemley, Pressure-induced transformations of multiferroic relaxor $\text{PbFe}_{0.5}\text{Nb}_{0.5}\text{O}_3$, *J. Appl. Phys.* **123**, 084102 (2018).
641. Huang, Q., J. M. Rodgers, R. J. Hemley, and T. Ichiye, Quasiharmonic analysis of the energy landscapes of dihydrofolate reductase from piezophiles and mesophiles, *J. Phys. Chem. B* **122**, 5527-5533 (2018).
642. Ransom, T. C., M. Ahart, R. J. Hemley, and C. M. Roland, Acoustic properties and density of polyurea at pressure up to 13.5 GPa through Brillouin scattering spectroscopy, *J. Appl. Phys.* **123**, 195102 (2018).
643. Celliers, P. M., M. Millot, S. Brygoo, R. S. McWilliams, D. E. Fratanduono, J. R. Rygg, A. F. Goncharov, P. Loubeyre, J. H. Eggert, J. L. Peterson, N. B. Meezan, S. Le Pape, G. W. Collins, R. Jeanloz, and R. J. Hemley, Insulator-metal transition in dense fluid deuterium, *Science* **361**, 677-682 (2018).
644. Mishra, A. K., T. Muramatsu, H. Liu, Z. M. Geballe, M. Somayazulu, M. Ahart, M. Baldini, Y. Meng, E. Zurek, and R. J. Hemley, New calcium hydrides with mixed atomic and molecular hydrogen, *J. Phys. Chem. C* **122**, 19370-19378 (2018).
645. Liu, H., I. I. Naumov, Z. M. Geballe, M. Somayazulu, J. S. Tse, and R. J. Hemley, Dynamics and superconductivity in compressed lanthanum superhydride, *Phys. Rev. B* **98**, 100102(R) (2018).

2019

646. Ahart, M., M. Somayazulu, D. Popov, Y. Xie, X. Long, Z. G. Ye, R. E. Cohen, and R. J. Hemley, Pressure-induced transitions in ferroelectric single-crystal $\text{PbZr}_{0.54}\text{Ti}_{0.46}\text{O}_3$, *Ferroelectrics* **535**, 106-113 (2019).
647. Huang, Q., J. M. Rodgers, R. J. Hemley, and T. Ichiye, Pressure and temperature effects on loop motion in *Escherichia coli* and *Moritella profunda* dihydrofolate reductase, *High Press. Res.*, **39**, 225-237 (2019).
648. Huang, Q., J. M. Rodgers, R. J. Hemley, and T. Ichiye, Effects of pressure and temperature on the nanosecond dynamics of dihydrofolate reductase from a psychropiezophile and a mesophile, *Int. J. Molec. Sci.* DOI:10.3390/ijms20061452 (2019).

649. Somayazulu, M., M. Ahart, A. K. Mishra, Z. M. Geballe, M. Baldini, Y. Meng, V. V. Struzhkin, and R. J. Hemley, Evidence for superconductivity above 260 K in lanthanum superhydride at megabar pressures, *Phys. Rev. Lett.* **122**, 027001 (2019).
650. Celliers, P. M., M. Millot, S. Brygoo, R. S. McWilliams, D. E. Fratanduono, J. R. Rygg, A. F. Goncharov, P. Loubeyre, J. H. Eggert, J. L. Peterson, N. B. Meezan, S. Le Pape, G. W. Collins, R. Jeanloz, and R. J. Hemley, Response to comment: Insulator-metal transition in dense fluid deuterium, *Science*, 10.1126/science.aaw1970 (2019).
651. Hemley, R. J., M. Ahart, H. Liu, and M. Somayazulu, Road to room-temperature superconductivity: T_c above 260 K in lanthanum superhydride under pressure, *Proceedings of the International Symposium - Superconductivity and Pressure: A Fruitful Relationship on the Road to Room Temperature Superconductivity - May 21–22, 2018, Madrid, Spain*, edited by M. A. Alario y Franco (Fundación Ramón Areces, Madrid, 2019), pp. 199-213.

2020

652. Borgschulte, A., J. Terreni, E. Billeter, L. Daemen, Y. Cheng, A. Pandey, Z. Łodziana, R. J. Hemley, and A. J. Ramirez-Cuesta, Inelastic neutron scattering evidence for anomalous H-H distances in metal hydrides, *Proc. Natl. Acad. Sci.* **117**, 4021-4026 (2020).
653. Huang, P., H. Liu, J. Lv, Q. Li, C. Long, Y. Wang, C. Chen, R. J. Hemley, and Y. Ma, Stability of H_3O at extreme conditions: Implications for the magnetic fields of Uranus and Neptune, *Proc. Natl. Acad. Sci.* **117**, 5638-5643 (2020).
654. Cui, W., T. Bi, J. Shi, Y. Li, H. Liu, E. Zurek, and R. J. Hemley, New route to high- T_c superconductivity via CH_4 intercalated H_3S hydride perovskites, *Phys. Rev. B* **101**, 134504 (2020).
655. Anzolini, C., K. Marquardt, V. Stagno, L. Bindi, D. J. Frost, D. G. Pearson, J. W. Harris, R. J. Hemley, and F. Nestola, Evidence for complex iron oxides in the deep mantle from FeNi(Cu) inclusions in superdeep diamond, *Proc. Natl. Acad. Sci.* **117**, 21088–21094 (2020).
656. Hendrickson, A. T., K. W. Hemawan, M. G. Coco Jr., S. C. Aro, S. A. McDaniel, P. J. Sazio, G. Cook, J. V. Badding, and R. J. Hemley, Diamond encapsulated silicon optical fibers synthesized by chemical vapor deposition, *AIP Advances* **10**, 095009 (2020).
657. Ge, Y., F. Zhang, R. P. Dias, R. J. Hemley, and Y. Yao, Hole-doped room-temperature superconductivity in $H_3S_{1-x}Z_x$ ($Z=C, Si$), *Materials Today Phys.* **15**, 100330 (2020).

2021

658. Geballe, Z. M., M. Somayazulu, N. Armanet, A. K. Mishra, M. Ahart, and R. J. Hemley, High pressure synthesis and thermodynamic stability of $PdH_{1\pm\epsilon}$ to 8 GPa, *Phys. Rev. B*, **103**, 024515 (2021).
659. Wang, H., Y. Yao, F. Peng, H. Liu, and R. J. Hemley, Quantum and classical proton diffusion in superconducting clathrate hydrides, *Phys. Rev. Lett.*, **126**, 117002 (2021).
660. Bi, T., A. Shamp, T. Terpstra, R. J. Hemley, and E. Zurek, The Li-F-H ternary system at high pressures, arXiv:2012.15336, *J. Chem. Phys.*, **154**, 124709 (2021).
661. Grockowiak, A. D., M. Ahart, T. Helm, W. A. Coniglio, R. Kumar, K. Glazyrin, G. Garbarino, Y. Meng, M. Oliff, V. Williams, N. W. Ashcroft, R. J. Hemley, M. Somayazulu,

- and S. W. Tozer, Superconductivity beyond 500 K in a La-based superhydride, arXiv: 2006.03004.
662. Guan, P.-W. R. J. Hemley, and V. Viswanathan, Combining pressure and electrochemistry to synthesize superhydrides. arXiv:2007.15613, *Proc. Natl. Acad. Sci.* in press.
 663. Ge, Y., F. Zhang, and R. J. Hemley, Room-temperature superconductivity in boron-nitrogen doped lanthanum superhydride, arXiv: 2012.13398.
 664. Lim, J., A. C. Hire, Y. Quan, J. Kim, L. Fanfarillo, S. R. Xie, R. S. Kumar, C. Park, R. J. Hemley, Y. K. Vohra, R. G. Hennig, P. J. Hirschfeld, G. R. Stewart, and J. J. Hamlin, High pressure study of low- Z superconductor Be_{22}Re , *Phys. Rev. B* **104**, 064505.
 665. Liang, X., A. Bergara, X. Wei, L. Wang, R. Sun, H. Liu, R. J. Hemley, L. Wang, G. Gao, and Y. Tian, Prediction of high- T_c superconductivity in ternary lanthanum borohydrides, *Phys. Rev. B*, **104**, 134501 (2021).
 666. Hemley, R. J., Toward hot superconductivity, *J. Phys.: Condens. Matter*, in press.
 667. Lamichhane, A., R. Kumar, M. Ahart, N. Salke, N. Dasenbrock-Gammon, E. Snider, Y. Meng, B. Lavina, S. Chariton, V. B. Prakapenka, M. Somayazulu, R. P. Dias, and R. J. Hemley, X-ray diffraction and equation of state of the C-S-H room-temperature superconductor, *J. Chem. Phys.* **155**, 114703 (2021).
 668. Song, X., C. Liu, Q. Li, R. J. Hemley, Y. Ma, and C. Chen, Stress-induced high- T_c superconductivity in solid molecular hydrogen, *Phys. Rev. Lett.*, submitted.
 669. Wang, X., T. Bi, K. P. Hilleke, A. Lamichhane, R. J. Hemley, and E. Zurek, A little bit of carbon can do a lot for superconductivity in H_3S , arXiv: 2109.09898.
 670. Lim, J., A. C. Hire, Y. Quan, J. S. Kim, S. R. Xie, R. S. Kumar, D. Popov, C. Park, R. J. Hemley, J. J. Hamlin, R. G. Hennig, P. J. Hirschfeld, and G. R. Stewart, Creating superconductivity in WB_2 through pressure-induced metastable planar defects, arXiv: 2109.11521.
 671. Guan, P.-W., Y. Sun, R. J. Hemley, H. Liu, Y. Ma, and V. Viswanathan, Low-pressure electrochemical synthesis of complex high-pressure superconducting superhydrides, *Phys. Rev. Lett.*, submitted.
 672. Zhang, Y., K. Luo, M. Hou, P. Driscoll, N. P. Salke, J. Minár, V. B. Prakapenka, E. Greenberg, R. J. Hemley, R. E. Cohen, and J.-F. Lin, Thermal conductivity of Fe-Si alloys and thermal stratification in Earth's core, *Proc. Natl. Acad. Sci.*, submitted.
 673. Kumar, R., Y. Zhang, Y. Xiao, M. Hu, Z. Fisk, P. Chow, E. Alp, A. L. Cornelius, R. J. Hemley, and C. Chen, Crystal structure and phonon density of states of FeSi to megabar pressures, submitted.

Other Publications:

1. Hemley, R. J., High pressure studies of planetary gases and liquids, *Eos Trans. Am. Geophys. Union* **69**, 159-160 (1988).
2. Hemley, R. J., Acceptance of the Mineralogical Society of America Award for 1990, *Am. Mineral.* **76**, 1741-1742 (1991).
3. Hemley, R. J., Presentation of the Mineralogical Society of America Dana Medal for 2009 to Ronald E. Cohen, *Am. Mineral.* **95**, 668 (2010).
3. Hemley, R. J., Presentation of the Distinguished Public Service Medal of the Mineralogical Society of America for 2009, *Am. Mineral.* **95**, 666 (2010).

4. Ernst, W. G. and R. J. Hemley, Francis Raymond Boyd, Jr., January 30, 1936-January 12, 2004, in *Biographical Memoirs of the National Academy of Sciences* (National Academies Press, Washington, DC, 2014).
5. Hemley, R. J., Carbon in Earth: Quantities, Movements, Forms, and Origins, *Midterm Scientific Report of the Deep Carbon Observatory* (A. P. Sloan Foundation, New York, 2014).
6. Hemley, R. J., Presentation of the 2016 Roebling Medal of the Mineralogical Society of America to Robert M. Hazen, *Am. Mineral.* **102**, 1133 (2017).