Fluorescent diamond nanoparticles (FNDs) represent a key component in recent development of ultra-high precision optical resolution techniques. FNDs can accommodate nitrogen-vacancy (NV) centers – an extremely photostable crystal lattice defect emitting in near-infrared region. Electron transitions among NV quantum states can be influenced by very weak external electric or magnetic fields, which have been utilized for construction of various types of probes and nanosensors. For application of FNDs in biological systems, a precise and better control of particles’ surface and electronic properties is still required.

Different needs coming from chemistry and physics sides will be discussed and synthetic approaches towards bioapplicable FNDs will be presented. Specifically, boosting the emission intensity and narrowing its distribution within the FNDs, decreasing the polydispersity of particles and shaping them to become pseudospherical, creation of antifouling polymeric coating on FNDs and its bioorthogonal modification with various (bio)molecules using click chemistry, and targeting the cancer cells using these conjugates will be shown. Coating of FNDs with a thin gold layer providing plasmonic nanodiamonds and application of these nanoarchitectures as highly effective optothermal converters in cancer thermoablation will be also discussed.