# Detonation Nanodiamond Particles in Electronic and Optical Applications

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Recent achievements in production of colloidal suspensions of individual nanodiamond particles only 4-5nm in size (so called single-digit nanodiamond) and the controlled production of nitrogen-vacancy centers in nanoscale diamond opened unprecedented perspectives in electronics and optical applications of nanodiamonds. Production of nanodiamond particles containing specific impurity defects seems poised to revolutionize biological imaging and quantum optics applications, while nanometer-sized diamond particles are indispensable for seeding of substrates for growth of diamond films by chemical vapor deposition. The range of applications of NDs in electronics can be very broad if electrically conductive ND particles can be synthesized. Production of conductive doped ND particles can be very beneficial in high surface area carbon electrodes for electroanalysis, electrochemical double-layer capacitors, storage materials for batteries and other applications. Nanodiamond-derived conductive onion-like carbon nanoparticles are already being explored in carbon electrodes applications.

The two major breakthroughs, the production of ND particles 4-5nm in size and ND particles containing impurity defects exhibiting stable luminescence and unique spin properties are related to nanodiamond particles synthesized by different techniques, detonation of explosives and grinding of HPHT diamond, correspondingly. Owing to the lack of optically active particles containing NV centers in useful amounts, ND synthesized from explosives is generally not amongst the preferred candidates for imaging applications. In this paper, systematic studies on nitrogen control in NDs produced by detonation shock wave-assisted synthesis will be reported. Nitrogen content in representative classes of NDs produced by detonation shock wave conversion of different carbon precursor materials, namely graphite and a graphite\hexogen mixture into ND, as well as ND produced from different combinations of explosives using different cooling methods (wet or dry cooling) will be discussed. Perspectives of production of NV centers in detonation NDs (DND) will be summarized. Perspectives in the production of photoluminescent DNDs imparted by other means will be also discussed. Namely, it will be reported that carbon dots decorated DND can be produced from detonation soot demonstrating surprisingly strong photoluminescence of different colors depending on the conditions of treatment and the type of soot treated. Other recent advances in DND applications, particularly in seeding of substrates will be briefly surveyed and areas of future scientific research highlighted.