Origin matters; fingerprints in nanodiamonds from different synthetic methods

Stepan Stehlik1, 2

1 Institute of Physics of the Czech Academy of Sciences, Cukrovarnická 10, 162 00 Prague, Czechia

2 New Technologies – Research Centre, University of West Bohemia, Univerzitní 8, 306 14, Pilsen, Czechia

*stehlik@fzu.cz**;* *steste@ntc.zcu.cz*

Nanodiamonds (NDs) hold promise for a vast range of various distinct applications including drug delivery, cellular labeling and imaging, quantum sensing (such as thermometry and magnetic field/spin sensing), selective biomolecule binding or energy harvesting, and (photo)catalysis - to name a few. Although researchers employ nanodiamonds in all these applications, due to the great variety of this nanomaterial, the actual nanoparticles used can differ substantially. Sometimes to the extent that they could be defined as a different material.

In this contribution, the two most common ND types, detonation NDs (DNDs) and high-pressure high-temperature NDs will be introduced and their properties will be discussed reflecting the specifics of the synthetic methods. First, an overview of the two synthesis methods is given followed by a summary of the respective ND material properties, including both ND size, core and surface structure, and surface chemistry. The presentation aims to critically compare the commercially available DND and HPHT types of nanodiamond particles and some non-commercial samples, highlighting their differences, similarities, and suitability for diverse applications.

**Biography of Dr. Stepan Stehlik**

Dr. Stepan Stehlik graduated from materials engineering in 2006 at the University of Pardubice, Czech Republic, and obtained his Ph.D. there in 2010 in the field of Chemistry and Technology of Inorganic Materials. In his early research career, he focused on solid-state electrolytes based on chalcogenide glasses doped with silver. He joined the group of Bohuslav Rezek at the Institute of Physics of the Czech Academy of Sciences in Prague in 2011 as a postdoc. Since then, he has been working on diamonds, especially nanodiamonds. He focuses on the comprehensive understanding of the relationships between fabrication, structure, size, surface chemistry, and colloidal and optoelectronic properties of nanodiamonds with potential use in biomedical, environmental, and optoelectronic applications. Since 2017 he became the leader of the Nanoparticles and Interfaces research group. From 2022 he also works at the New Technologies Research Center at the West Bohemian University in Pilsen. Stepan Stehlik is or was the principal investigator and co-investigator of several national and international projects and is the author and co-author of 46 publications.