ODMR active bright sintered detonation nanodiamonds obtained without irradiation

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We present the results of study the structure and composition of microcrystalline diamonds obtained by high-pressure high temperature sintering of detonation nanodiamond particles. Using optical detected magnetic resonance method, photoluminescence spectroscopy and Raman spectroscopy we found sintering of detonation nanodiamond significantly differ from initial detonation nanodiamonds and can be compared to high quality diamonds. Monocrystals of diamonds obtained by the method of oriented attachment have dimensions of up to tens of microns, possess the habitus of high-quality diamonds, and do not contain metal catalysts in the lattice structure. In those crystals, the presence of optically active nitrogen impurities in the crystal lattice is observed. In particular, there is a bright nitrogen-vacancy defects. They are characterized by optical detected magnetic resonance method, which shows that spin properties of the obtained single crystals correspond to high-quality natural diamonds and surpass synthetic diamonds obtained from graphite in the presence of metal catalysts, followed by irradiation and annealing to obtain nitrogen-vacancy defects optical defects in the diamond lattice. The presence of nitrogen-vacancy defects defects and the high-quality of the crystal structure of sintering of detonation nanodiamond allows us to consider them as potential candidates in quantum magnetometry. For this purpose, the possibility of a simple way to improve the AFM probe by fixing a microcrystalline sintering of detonation nanodiamond particle on its tip is demonstrated.

Keywords: detonation nanodiamond, HPHT sintering, ODMR, single crystalline, photoluminescence, defects.

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