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Room Temperature High-Field Spin Dynamics of NV Defects in Sintered Diamonds

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Abstract

Sintered oriented nanodiamond arrays with the extremely high concentrations of the nitrogen-vacancy (NV) centers (up to 103 ppm) were investigated by the W-band (94 GHz) electron spin echo electron paramagnetic resonance techniques. The NV centers were fabricated by the high-pressure high-temperature sintering of detonation nanodiamonds (DND) without the post or prior irradiation of the samples. The processes of polarization and recovery of the equilibrium population of the spin sublevels by optical and microwave pulses have been examined at room temperature in high magnetic fields corresponding to the fine-structure transitions for the NV defects at 94 GHz (3,250-3,450 mT). A long spin coherence time of 1.6 μs and spin-lattice relaxation time of 1.7 ms were measured. The results were compared with those obtained on the NV centers fabricated by the irradiation and subsequent annealing of the commercially available bulk diamonds. It was shown that the relaxation characteristics of the NV defects were similar in the both types of the samples despite the extremely high concentrations of NV defects and isolated nitrogen donors in the sintered DND.

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