

ODMR studies of fluorescent nitrogen-vacancy defects fabricated by sintering of detonation nanodiamonds

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Nitrogen-vacancy (NV) centres in diamond are one of the most prominent objects for applications in new generation of supersensitive magnetometers, biosensors which demand very bright and photostable fluorescence from high-density nitrogen-vacancy ensembles located in diamond core of nanoparticles. Fluorescence brightness strongly depends on the concentration of NV centres and the diamond quality. Although NV centres have effectively been generated in diamond by irradiation and following high temperature annealing they have not been observed in high concentrations in non-irradiated diamonds. Enormously high concentrations of NV centres going as high as 1% (10000 ppm) can be produced directly by high-pressure high-temperature sintering of detonation nanodiamonds (NV-diamond) without any post or prior irradiation of the samples.

Intensive fluorescence spectra with quite well distinguished zero-phonon line related to negatively charged NV centres even at the room temperature were observed. Anisotropic optically detected magnetic resonance (ODMR) and electron paramagnetic resonance (EPR) signals of NV centres and isolated nitrogen (N) have been detected in single arrays showing that sintering leads to self-organization of nanodiamond particles in oriented micron-size arrays which include high concentrations of NV and N centres.

In zero-field ODMR of NV centers which observed right up to room temperature the side band satellites observed which arise from triplet-doublet magnetic dipolar interactions of NV and N centers. Micron size single arrays of NV-diamond could be used as a very sensitive device for measuring of weak magnetic fields in micron scale.

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