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Extended Materials Science look at MPCVD NV centers

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The magnetic-field-dependent fluorescence properties of NV^- center defects embedded within a diamond matrix have made them a candidate for solid state qubits for quantum computing as well as magnetic field sensing. Microwave plasma assisted chemical vapor deposition (MPCVD) of diamond with \emph{in situ} nitrogen doping has provided reproducibility and uniformity in the production of NV^- centers on multiple substrates[1]. What has yet to be understood is the impact of the nitrogen doping time on the MPCVD process and its impact on the creation of NV^- centers.
Analysis of the NV^--containing diamond films has been carried out using Scanning Electron Microscopy (SEM), X-ray Diffraction (XRD), Raman spectroscopy, Photoluminesence spectroscopy, and optical microscopy. In addition, calculated plasma parameters and models have been used to quantify the properties of the MPCVD process.This study aims to investigate the effect of nitrogen doping time and its effect on the produced spectral lines associated with the 1333 cm^{-1} Diamond Raman spectra peak, 637 nm photoluminesence NV^- spectral peak, and the <111> and <220> diamond XRD peaks. A quantifiable/measurable relationship between spectral peaks, NV^- density, and nitrogen doping time in terms of MPCVD process parameters is presented.

Keyword-1

plasma

Keyword-2

diamond

Keyword-3

materials

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