



Canadian Association  
of Physicists

Association canadienne  
des physiciens et physiciennes

Contribution ID: 4014 Type: **Poster Competition (Graduate Student)** / **Compétition affiches (Étudiant(e) 2e ou 3e cycle)**

## (G\*) (POS-12) MPCVD Diamond Films with varying Nitrogen Doping Times : Effect on NV Center Synthesis

*Tuesday 20 June 2023 17:36 (2 minutes)*

NV centers in a diamond crystal consist of a substitutional nitrogen atom next to a lattice vacancy. These commonly appear in two distinct charge states, the neutral NV center ( $NV^0$ ) and the negatively charged NV center ( $NV^-$ ). While the more commonly formed state is the  $NV^0$ , the  $NV^-$  center has  $S = 1$  fine structure that has important magnetic field dependent fluorescence properties due to its trapped electron. Fluorescence of the  $NV^-$  center has many applications include bio-labelling, thermometry, magnetometry, and quantum information, among many others. Research to improve the uniformity and replicability of manufactured  $NV^-$  center-containing films is of great importance. Microwave plasma assisted chemical vapor deposition (MPCVD) of diamond with *in situ* nitrogen doping has shown promise in the synthesis of these heteroepitaxially grown centers[1]. Currently the effect of different nitrogen doping times on the growth of  $NV^-$  centers is not well understood.

This poster will present the results of an investigation of varying  $N_2$  doping times during diamond synthesis and how this affects the growth of both  $NV^0$  and  $NV^-$  centers within polycrystalline MPCVD diamond films. Investigation with Raman spectroscopy, photoluminescence spectroscopy and X-ray diffraction were carried out. By increasing or decreasing the  $N_2$  doping time and studying the variation of the intensity of the 637 nm  $NV^-$  photoluminescence (PL) spectral line, we derive a relationship between doping time and density of  $NV^-$  centers.

[1] Ejalonibu, H. A., Sarty, G. E., Bradley, M. P. (2019, April 25). "Optimal parameter(s) for the synthesis of nitrogen-vacancy (NV) centres in polycrystalline diamonds at low pressure" - *Journal of Materials Science: Materials in Electronics*. SpringerLink. <https://link.springer.com/article/10.1007/s10854-019-01376-z>

### Keyword-1

nitrogen vacancy centers

### Keyword-2

microwave plasma

### Keyword-3

chemical vapor depositions

**Author:** DAVIS, William (University of Saskatchewan)

**Co-author:** BRADLEY, Michael

**Presenter:** DAVIS, William (University of Saskatchewan)

**Session Classification:** DPP Poster Session & Student Poster Competition (3) | Session d'affiches DPP et concours d'affiches étudiantes (3)

**Track Classification:** Technical Sessions / Sessions techniques: Plasma Physics / Physique des plasmas (DPP)