TEMPERATURE DEPENDENT PHOTOLUMINESCENCE MEASUREMENTS OF SI-V COLOUR CENTRES FABRICATED IN DIAMOND THIN FILMS

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Abstract

In this work, we study the influence of growth process parameters on photoluminescence activity of Si-V colour centres in diamond. The diamond films were grown by microwave plasma enhanced CVD system. Temperature dependent steady-state photoluminescence of Si-V centres was measured within the range 11-300 K. Photoluminescence measurements are correlated with process parameters (i.e. the influence of CO2 (up to 4.5%) or N2 (up to 6.0%) addition into the H2/CH4 gas mixture, and the substrate temperature (350–1100°C)). Adding of CO2 or N2 in the gas mixture monotonically suppressed the PL intensity, while 800°C was the optimal substrate temperature at which the highest photoluminescence activity of Si-V centre was measured. For all the samples, the temperature dependent PL measurements exhibited the blue shift in zero-phonon line (ZPL) position for lower temperatures and for selected samples, ZPL narrowing were observed. This effect will be discussed from point of temperature behaviour of Si-V electronic transition energy. A technological control of Si-V colour centre activities is perspective for life science and photonic applications.

Keywords: Silicon-vacancy centres, CVD diamond, photoluminescence

Author did not supply full text of the paper.