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OPTICAL EMISSION SPECTROSCOPY OF MICROWAVE PLASMA IN H_2-CH_4-GeH_4 MIXTURES DURING DIAMOND DOPING WITH GERMANIUM *)

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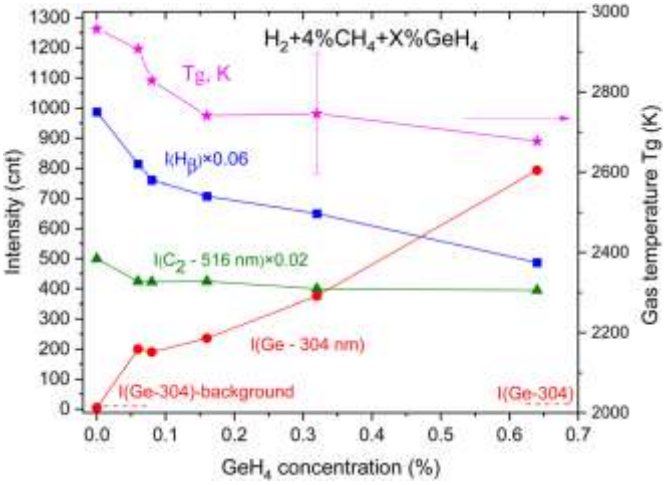
We have realized the deposition of doped Ge-epitaxial diamond layers with germanium-vacancy (GeV) color centers. GeV centers, which have narrow-band photoluminescence (PL) emission in the orange spectral range, are interesting as a source of single photons for quantum optical technologies, thermometry, and optical biomarkers. Doping during diamond growth was carried out in the ARDIS-100 microwave plasma-chemical reactor (2.45 GHz) by adding germanium gas GeH4 to the H2-CH4 plasma [1]. Single-crystal HPHT diamond plates with (111) and (100) orientations was used as substrates. Plasma diagnostics were carried out using optical emission spectroscopy (OES) on an M833 spectrometer (Solar Laser System).

The dynamics of the intensity of the main lines (Ge, Hβ and C2) in the OE spectra with variation in the concentration of GeH4 in the mixture, reflecting the complex chemistry in the plasma, has been studied. It was found that the gas temperature Tg monotonically decreases from 2980 K to 2690 K with the addition of germanium (0.7%). From the ratio of the intensities of the Balmer series lines, the electronic excitation temperature Texc was estimated. The PL spectra of the grown single-crystal layers were measured and it was shown that, under certain conditions, GeV centers emitting at a wavelength of 602 nm are formed. It was found that the efficiency of doping the diamond face with the (111) orientation is significantly higher than for the (100) face.



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References

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*) abstracts of this report in Russian