ANALYSIS OF THE EFFECT OF NITROGEN IN SYNTHESIS OF DIAMOND-LIKE FILMS WITH DIFFERENT METHODS OF GAS ACTIVATION [[1]](#footnote-1)\*)

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In this paper, the effect of nitrogen additions on the synthesis of diamond films with various methods of precursor activation is analyzed: 1) in a microwave plasma at a flow of gases at moderate pressures; 2) in a microwave chamber at low pressure [1]; and 3) in a flow of gases activated by a heated tungsten filament [2].

Nitrogen additions are of interest, because there appear vacancies at nitrogen additions [3] which, at a concentration of more than 0.1%, are of particular importance for thermodynamic stabilization of the structure with respect to the diamond-graphite transition [4], providing CVD growth of diamond in a metastable state. Nitrogen is also the most suitable candidate for the role of a doping agent in obtaining electronic impurity conductivity with a deep donor energy level (of about 1.7 eV). When diamond is used as a low-dimensional system for quantum informatics, nitrogen-vacancy (NV) defects hold much promise. Finally, the addition of nitrogen to the gas mixture accelerates the growth of {100} faces with respect to {111} up to 4 times [5], which allows controlling the structure of diamond crystals in the process of gas-phase chemical deposition.

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| Fig. 1. SEM images: a) sample no. 543 (without nitrogen);  b) sample no. 544 (with the addition of 0.1% nitrogen).  Fig. 2. Raman spectrum of a diamond-like film obtained with activation of a gas mixture by a heated tungsten filament. | |

The results of measuring the Raman spectrum show that the optimal content of nitrogen in the mixture is not more than 0.1%. Nitrogen addition narrows the diamond line near 1333 cm-1 (in our case from 20 cm-1 to 7 cm-1). The character of the G-line indicates that the graphite that is present is in a highly disordered (soot-like) state. Higher ordering of crystals with the addition of nitrogen is also confirmed by SEM images.

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVIII/Pt/ru/GC-Medvedev.docx) [↑](#footnote-ref-1)