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CHARACTERISTICS OF THE INTERACTION OF ATMOSPHERIC PRESSURE MICROWAVE TORCH WITH NANOCARBON FILMS USED AS PRE-SEEDS ON SILICON SUBSTRATES FOR MPCVD TECHNOLOGY *)

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Plasma deposition systems for carbon and diamond films are useful in the manufacture of integrated radiation and temperature sensors.

The diamond film is usually deposited on a silicon substrate. To improve adhesion and control crystal orientation during the deposition process, an initial seed layer must be created. The quality of the seed layer determines the quality of the resulting film. Typically, this is done by depositing nano-sized particles in an ultrasonic bath or by applying a colloidal solution of particles to the surface and then drying. The disadvantage of these methods is the inhomogeneity (relief) of the resulting seed layer.

In the proposed work, inoculum films were obtained by an original method of vertical deposition of nanoparticles of colloidal nanocarbon solution in ethanol [1] on silicon substrates. This method allows to obtain a more homogeneous seedling. To test the stability of seeding, the samples were placed in a microwave plasma torch. The peculiarity of the used installation is that the torch is created at atmospheric pressure, which allows to have a large density of active particles in the gas phase in the volume of the torch, high gas temperature and a large value of particle flux on the substrate surface [2]. All these factors can negatively affect the initial seeding and subsequent growth of layers.

The paper compares the surface profile of silicon substrates seeded by the methods mentioned earlier, which were treated by the plume at different temperature, flow, and concentration of the initial gases. The spatial distribution of gas and electron temperatures in the microwave plume was obtained using optical emission spectroscopy along the main axis of the plume. The surface temperature of a silicon substrate placed in different zones of the plume was determined by IR pyrometry. Preliminary results of the study show the potential possibility of using the seeding method [1] for the growth of diamond-like and carbon films.

References

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