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Gas discharge synthesis of silver sulphide surface nanostructures in argon

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The modern development of nanotechnology requires an increasing number of different nanostructured elements for use in photovoltaics, sensor, laser and optoelectronic technology, photobiology and medicine, the synthesis of which is hindered by the lack of data on the basic conditions and physical mechanisms of the synthesis of surface nanostructures from gas discharge plasma products. Currently, there is no data on the relationship between the characteristics of nanostructures of superionic conductors with the characteristics of overvoltage nanosecond discharges in gases of different pressures and compositions and the characteristics of the corresponding nanostructures.

The report presents the results of research of the characteristics and transport parameters of an overvoltage nanosecond discharge in argon between electrodes made of a superionic conductor - silver sulfide (Ag_2S). The discharge was ignited at argon pressures of 13.3 - 101 kPa, and the distance between the electrodes made of the polycrystalline Ag_2S compound was 2 mm. Destruction of the electrode material during the discharge and introduction of Ag_2S vapors into the interelectrode gap occurred due to microexplosions of natural inhomogeneities on the working surfaces of the electrodes. The discharge can be used as a plasma chemical reactor for the synthesis of thin films based on silver sulfide. The results of the Raman scattering spectra of laser radiation by synthesized films based on the Ag_2S compound are presented.

A study of the characteristics of a discharge plasma in argon between electrodes made of the Ag_2S compound revealed the following:

- the maximum voltage amplitude of one polarity on the discharge gap reached 22 kV, and individual oscillations on the voltage pulse had a duration of 5-10 ns;

the maximum amplitude of the current pulses reached 100 A, the value of the pulse electric power - 10 MW with the energy in a single pulse - 119 mJ;

- the spectrum of ultraviolet radiation of the discharge was dominated by the radiation of atoms of singly charged silver ions in the spectral range of 200-300 nm and of silver atoms in the spectral range of 300-340 nm;

- Investigation of the Raman spectra of laser radiation scattering by thin films synthesized from plasma based on the gas-vapor mixture "argon - silver sulfide" showed that they consist of silver sulfide, which can be used for the development of various devices based on.