Obtaining of silicon nanoclusters by the PECVD method

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Currently, due to the intensive development of nanotechnology, there is an increased interest in the study of nano-sized objects such as quantum wells, quantum wires, quantum dots, *etc*. In such nanoscale objects, the de Broglie wavelength of the electron is commensurate with the size of the object in one or more dimensions, which causes quantum mechanical effects in contrast to bulk materials. These effects are well manifested in the optical, electronic, and magnetic properties [1] of semiconductor materials. Consequently, they find many applications in microelectronics, medicine, solar energy, *etc*. Silicon is the most widely used semiconductor material in modern electronics and microelectronics. Therefore, research on the formation and modification of the parameters of silicon nanostructures is a very urgent task. Silicon nanoparticals exhibit quantum properties at temperatures up to room temperature, which is of practical interest [2] in the implementation of devices based on these materials.

In the present work, silicon nanocrystals were obtained in a pulsed dust-forming plasma generated in a high-frequency capacitive Ar + SiH_4 discharge at low pressure (figure 1). The experimental setup includes a vacuum reactor, a high-frequency generator, a matching device, and DC power supplies for the generation of an electric field during deposition. The obtained results were analyzed using AFM, SEM, TEM, XPS, UPS, and UV-VIS spectroscopy. The self-bias voltage was used to control the orientation of the nanoparticles just before their deposition. The dependence of the work function of the resulting substrate material on the size of the deposited nanoparticles will be discussed in detail during our presentation.

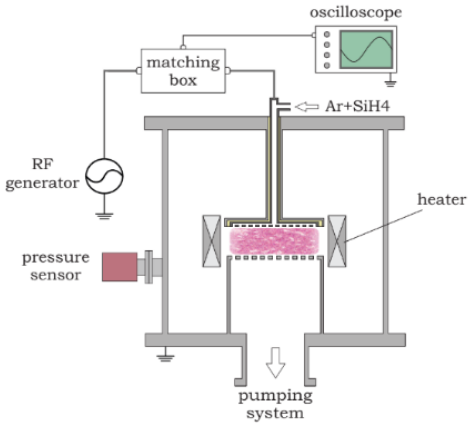

Fig. 1: Schematic of an experimental setup for the obtaining of silicon nanoclusters

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