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Creation of nano-objects for nanoelectronics and spintronics

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Among the promising and innovative technologies of today, nanoelectromechanical systems, nanoelectronics, and its subdivision - spintronics, occupy a leading place. At the same time, one-dimensional structures - nanocontacts and nanowires - are of particular interest, based on which it is possible to form highly efficient nanocircuits with small dimensions and low power consumption. However, during the formation of nanocontacts and nanowires, elastic stresses arise in their structure, which can significantly change the atomic structure and geometry of the wire or contact up to the rupture of the structure, which subsequently leads to a significant change in their mechanical and quantum properties. In addition, the properties of nanowires and nanocontacts formed on various non-magnetic substrates are being actively studied today. A nanowire formed on a substrate is the prototype of a nanoscale electronic circuit, therefore, the study of interactions in the “nanowire-substrate” system is one of the priority areas of nanoelectronics and spintronics. In the presented work, a scanning tunneling microscope, “Micro-nano mode”, was used for the non-contact formation of nanorelief on the surface of metal substrates and interelectrode mass transfer with nanometer resolution. The fundamental possibility of non-contact modification of the surface of an indium nanofilm with a tunneling current by creating nano-objects on it was shown. A nano-object as a contact pad was obtained using the single-pass method. The dimensions of the nano-object in the form of a square were 1 μm by 1 μm, and the depth of the created nano-object was about 15 nm. The possibility of creating a group of nano-objects in the form of nanotracks (wires) obtained by modifying the surface non-contact using the two-pass technique was demonstrated. The dimensions of the nano-objects in the form of tracks (wires) were 1.5 μm by 0.4 μm and 1.5 μm by 0.8 μm, respectively, and the depth of the created nano-objects was about 7 nm.

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