«Nanostructured surfaces»

Surface topology of Ga_2O_3 thin nanostructured dielectric formed on p-GaTe – n-InSe interface

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Indium selenide (InSe) and gallium telluride (GaTe) are layered semiconductors of the A^3B^6 group with drastically anisotropic properties. The van der Waals surface of layered crystals allows their use as substrates for growing nanostructures and creating heterojunctions based on semiconductor materials with different symmetry and lattice period.

InSe and GaTe single crystals were grown from a nonstoichiometric melt by the Bridgman technique. Oxidation of gallium telluride surface was performed under ambient air at a temperature of 400°C for 4 hours. The surface topology of GaTe layered crystals was investigated by means of atomic force microscope Nanoscope IIIa Dimension 3000 SPM (Digital Instruments, USA). Photosensitive heterostructure p-GaTe – n-InSe was prepared by the method of mechanical contact of GaTe oxidized plate with van der Waals surface of InSe.

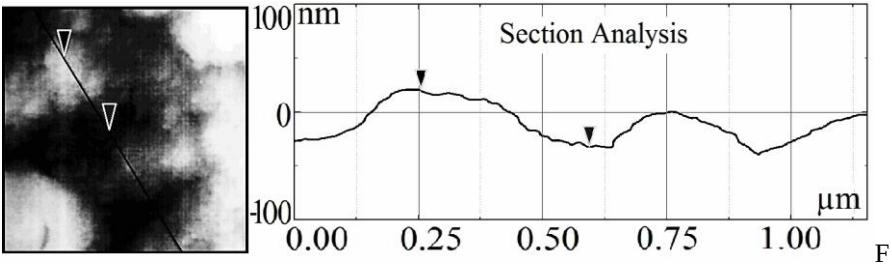

Fig. AFM topographic image of GaTe surface oxidized under ambient air at a temperature of 400°C for 4 hours.

Since the GaTe crystals have a layered structure where each layer consists of four covalently bonded monoatomic sheets in the sequence Te-Ga-Ga-Te, the interaction between the layers is performed by Te-Te Van der Waals bonds. During the oxidation of freshly cleaved surface of GaTe crystals, oxides of tellurium should be formed, and after it - oxides of gallium. However, the high oxidation temperature promotes sublimation and decay of tellurium oxide. Therefore, formed at high temperatures oxide layer corresponds gallium trioxide - Ga_2O_3. Lateral dimensions and height of oxide clusters varies within 250-500 ± 25 nm. This is evident from AFM topographic images of oxide surfaces shown in Fig.