The formation of the array of indium nanoislands by the laser deposition in vacuum

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Metallic nanostructures can enhance a light absorbtion and scattering due surface plasmon resonance effect. Traditional materials for the realization of the structures with specific plasmonic phenomena are the noble metals as Au or Ag. For with metals the plasmon resonances lie in the visible spectral region, that allow to use an ordinary light. In the same time so-called “poor metals” (PM) such aluminum, indium etc. exhibit plasmon resonance effects in the ultraviolet spectral range and consequently they are candidate materials for ultraviolet plasmonics. Moreover, the resonances can be shifted to visible range by the formation of PM nanostructures.

In this work we present the method for the formation of the array of indium nanoislands. The structures were fabricated in the form of InAlSb films with indium nanoinclusions deposited on different substrates (InGaAs/GaAs and Si/SiO2). In the vacuum chamber the solid targets (InSb, Al and Sb) were periodically ablated by Nd:YAG laser. The ratio of the time sputtering $t_{InSb}/t_{Al}/t_{Sb}$ and substrate temperature were varied. During the film growth in the conditions with lack of V-group element (Sb) the supplanting of the element with low-melting point (indium) occurs. Fig. 1 *a* and *b* shows the AFM scans (7x7 um) of the InAlSb films deposited at 250 °C on the InGaAs/GaAs and Si/SiO_2 substrates. The $t_{InSb}/t_{Al}/t_{Sb}$ ration was 6:1:0 (without Sb target). For this growth conditions the formation of the indium nanoislands occurs. The size of indium islands is about 400x150 nm. The insertion of addition Sb target allows to suppress the formation of indium islands due to indium reaction with antimony. Fig. 1 *c* shows the AFM scan (7x7 um) of the InAlSb film deposited at 250 °C with $t_{InSb}/t_{Al}/t_{Sb}$=5:1:1 on the InGaAs/GaAs substracte. The InAlSb layes are smooth without In islands (area RMS is about 3nm). The strip on the AFM image (fig. 3 *c*) are craquelures on the surface of the relaxed InGaAs buffer layer. The formation of the In nanoislandes also can be suppressed by temperature reduction.

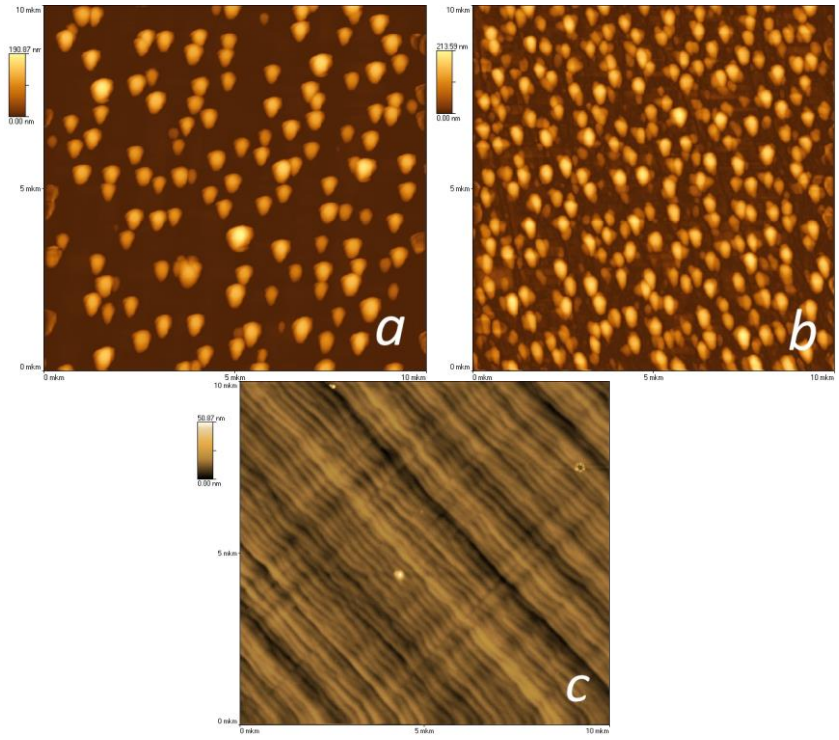

Fig. 1 The AFM scans (7x7 um) of the InAlSb films with (*a* and *b*) and without (*c*) indium nanoislands..

This study was supported by the Grant of President of Russian Federation (MK-8221.2016.2).

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