Physico-Chemical nanomaterials science

Scanning tunneling spectroscopy study of In/In_4Se_3 (100) nanosystem

P.V. Galiy[1], P. Mazur[2], A. Ciszewski[2], T.M. Nenchuk[1], I.R. Yarovets'[1]

[1] *Electronics and Computer Technology Department, Ivan Franko Lviv National University, 50 Dragomanov Street, Lviv, 79005, Ukraine.*
E-mail: galiy@electronics.lnu.edu.ua

[2] *Institute of Experimental Physics, University of Wrocław, pl. Maxa Borna 9, 50-204 Wrocław, Poland.*

Formation of nanosystems on the base of metal-semiconductor structures by self-assembling of induced metal on semiconductor template is the way to obtain novel nanosized functional devices. The layered semiconductor crystals In_4Se_3 were applied as templates in the process of formation of indium metallic structures on their (100) surface. These surfaces are characterized by furrowed and chainlike anisotropic structure relief that has been visualized by previous scanning tunneling microscopy (STM) study. The STM study revealed formation of zero or one – dimensional In induced surface structures dependent on the value of initial bulk resistivity of In_4Se_3 substrate.

Now we focus on scanning tunneling spectroscopy (STS) results to study the In metallic coverage formation kinetics of (100) In_4Se_3. The current imaging tunneling spectroscopy (CITS) mode was used to study the local density of states (LDOS) distribution over the surface of In/In_4Se_3 nanosystem. STS data were obtained by Omicron Nano Technology STM/AFM System operating with UHV better than 10^{-10} Torr at room temperature. Indium was deposited with application of UHV thermal evaporator EFM-3. The surfaces were thermo treated in situ after indium deposition at fixed temperatures up to 600 K.

The analysis of CITS data matrix (6400 (data points on the surface with 1/80 X (nm) x1/80 Y (nm) spatial distribution) x $n\Delta$V (V) (where *n*- quantity of discrete labels on the tip-surface voltage scale in the -4V up to +4V range)) with corresponding I-V curves allows to locate and visualize indium metallic clusters on (100) In_4Se_3 substrate. Indium concentration over the surface was calculated as ratio of data points with tunneling current value above the limited noise level within 0.67 eV In_4Se_3 energy gap to all studied points. STS data show that detected In clusters are localized in elongated shapes. These shapes and size of clusters corresponds to the nature of their formation through the localization to the furrowed cleavage structure of (100) In_4Se_3 surface along crystallographic ***c*** axis direction.