

Nanocomposites and nanomaterials

Formation of catalysts in the form of porous nanosystems Ni / Cu.

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Creation of multi-layers metallic porous nanostructures in the form of alternating layers of various metals is one of very promising direction in the thin-films technologies. The combination of especial and unique physical and chemical properties of the multi-layers structures has attracted significant interest to such materials. They can find practical application in various kinds of sensors, electronic devices and catalysts.

We have obtained porous multilayer nanosystems consisting of consistently successive layers of Ni and Cu. With this purpose, the magnetron sputtering operating under quasi-equilibrium steady-state condensation conditions have been used. The phase and element compositions of the received condensates have been studied. Besides that, the technological conditions required for reproducible porous nanosystems formation have been found.

The analysis of structural and morphological characteristics using of SEM and TEM have shown that Ni layers formation occurs without commonly known growth coalescence. This fact is caused by reorientation of Ni condensed flows into the areas of the primary clusters aggregation together with homogeneous nucleation of new clusters in the regions of primary clusters intergrowth.

For Cu layers we have defined the main growth mechanisms and the structure formation mechanisms of various types of porosity. The first one is caused by field selectivity. In this case, the depositing ions are focused onto the projecting parts of the growth surface. The second mechanism leads to formation on the growth surface mesoporous systems that have no crystal faceting. The third mechanism is based on formation of the structural fragments consisting of weakly bound with each other faceted nanocrystals.