The Effect of Nickel Intercalation on the Properties of In_2Se_3 Layered Crystals

Kushnir B.V., Boledzyuk V.B., Potsiluiko R.L.

Frantsevich Institute for Problems of Materials Science, NAS of Ukraine, Chernivtsi Department, Chernivtsi, Ukraine

In_2Se_3 is a layered semiconductor with defective structure of tetrahedral bonding, where one-third of the sites is vacant and forms a screw array along the c axis. In_2Se_3 layered crystals have been the subject of many investigations due to their peculiar electrical and optical properties, and their potential applications in various types of electronic and optoelectronic devices, phase-change random access memories, solid-state batteries, and solar cells, etc [1, 2].

In_2Se_3 single crystals were grown by the Bridgman modified method from a stoichiometric melt and characterized by a pronounced layered structure over the whole length of a sample. Intercalation of samples was performed by the electrochemical method in the course of the anodic reaction of intercalation in static gradient magnetic field of 50 A/m at the sample-electrolyte interface. $NiNO_3$ saturated aqueous solution was used as the electrolyte. The concentration of embedded Ni (x) was calculated according to Faraday's law.

The influence of Ni^{2+} ions intercalation on properties of In_2Se_3 monocrystals was investi-gated. It was shown that at the increase the concentration of Ni^{2+} ions the specific conductivity of In_2Se_3 crystals tends to decline (Fig.). The basic samples of In_2Se_3 single crystals are paramagnetic. It is found that $Ni_xIn_2Se_3$ samples have ferromagnetic properties at room temperature.

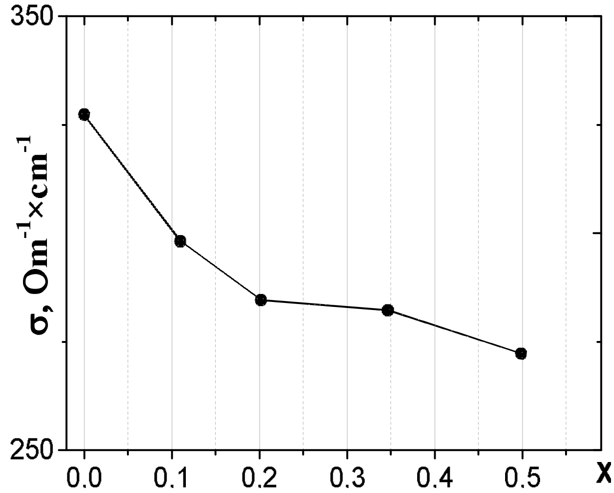

Fig. The dependence of σ⊥c layer-parallel electrical conduction for $Ni_xIn_2Se_3$

1. Julien C., Eddrief M., Kambas K., Balkanski M. // Mater. Sci. Eng. B. 1996.V. 38. N 1. P. 1–8.
2. Bakhtinov, A.P., Boledzyuk, V.B., Kovalyuk, Z.D., Kudrinskii, Z.R., Litvin, O.S., and Shevchenko, A.D., Phys. Solid State, 2013, vol. 55, no. 6, pp. 1148–1155.