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Transition metal-doped Sb_2Se_3 nanorods: growth, electrical and magnetic properties

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Diluted magnetic semiconductors (DMSs), which are prepared by substituting transition metals into nonmagnetic semiconductors, have attracted the worldwide scientific interests because of their unique electronic and magnetic properties [1]. Group V_2-VI_3 semiconductors which can be applied to practical device have been studied to detect the material of superior property, e.g. in thermoelectric devices, for several decades. Among of them, Sb_2Se_3 has attracted great interests because of possibility which can fabricate the Hall effect devices [2]. It has layer-structured semiconductor of orthorhombic crystal structure [3]. Here, we have synthesized TM (Transition Metal)-doped Sb_2Se_3 nanorods.

Single crystals of TM-doped Sb_2Se_3 were prepared from high-purity (99.999%) V, Cr, Mn, Fe, Co, Ni, Sb and Se powders with particle sizes <-200 meshes to maximize the surface area and thereby enhance the reaction kinetics. The powders were weighed and loaded into thick walled quartz ampoules. The ampoules were then evacuated ($<10^{-6}$ Torr) and sealed. The ampoules of TM-doped Sb_2Se_3 were heated to 900 °C at 30 °C/h followed by a 96h-soak. For single crystal nanorod growth, the temperature was slowly cooled at 1°C/h from 800 °C to 700 °C and thereafter at 100 °C/h.

The morphologies of TM-doped Sb_2Se_3 crystals were nanorods. In this talk, we will present the magnetic and electrical properties of TM-doped Sb_2Se_3 nanorods.

References

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