Phase Relations in the YbTe-SnTe-Bi_2Te_3 System

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Tellurides of bismuth and tin and complex phase on their based are perspective materials for creation of novel high-performance materials for thermoelectric and topological insulators.

This work presents the results of investigation of phase relations in the YbTe-SnTe-Bi_2Te_3 system.

The samples were prepared by melting of the high purity elements in evacuated (10^{-2}Pa) graphitized ampoules. The synthesis was realized in a tube furnace. The ampoules were heated to maximal temperature 1200 K. Then in order to achieve a state close to equilibrium, the reaction mixture was pressed into pellets and annealed at 800-1000K for 1000h.

DTA (NETZSCH 404 F1 Pegasus system), XRD (Bruker D8 ADVANCE diffractometer) and SEM–EDS (FEI Quanta™ 250 scanning electron microscope with Oxford Instruments energy dispersive X-ray spectrometer) techniques were employed to check the purity of the synthesized starting compounds and analyze the samples.

Based on experimental data the T-x phase diagrams of YbTe-SnTe, YbTe-Bi_2Te_3 systems, some isopleth sections, isothermal sections at 300 and 800 K of the phase diagram, as well as the projection of the liquidus surface (T<1400K) have been constructed.

It was found that the quasi-binary system YbTe-SnTe characterized by formation of continuous high-temperature solid solutions field with a cubic structure (α-phase). At temperatures below 950K the solid solutions are decompose. Solubility of the YbTe and SnTe are determined to be about 35 and 3 mol% at room temperature.

The system YbTe-Bi_2Te_3 is quasi-binary too and has a eutectic phase diagram. According to the SEM and XRD samples quenched from 800 K, the solubility YbTe in Bi_2Te_3 is about 12 mol%. Isothermal section of the phase diagram of the system YbTe-SnTe-Bi_2Te_3 at 300 and 800 K shows that the dominant role in the formation of phase areas in the subsolidus the solid solutions based YbTe are playing. This solid solutions form tie lines with all other phase.

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