Transport properties of new Pb-based Topological Insulators

KAZUMA ETO, SATOSHI SASAKI, KOUJI SEGAWA, YOICHI ANDO, Institute of Scientific and Industrial Research, Osaka University — A topological insulator (TI) has a gapped insulating bulk and a gapless metallic surface. So far, such materials as Bi$_{1-x}$Sb$_x$, Bi$_2$Se$_3$, and TlBiSe$_2$ are known to be TIs. Recently, several theoretical predictions have been made for new TI materials. In this work, we focus on the Pb-based ternary chalcogenides as new candidate TIs. We have grown a number of single crystals in the systems of Pb-Bi-Se, Pb-Bi-Te, Pb-Sb-Te and Pb-(Sb,Bi)-Te. After selecting single-phase samples, we measured the transport properties to check for their bulk-insulating nature. It was found that Pb(Sb$_x$Bi$_{1-x}$)$_2$Te$_4$ shows a change in the carrier type at around $x = 0.55$ as inferred both by the thermopower and by the Hall effect, but the temperature dependences of the resistivity remained metallic in all the samples studied. We discuss the prospect of making a bulk-insulating material in the Pb-based TIs.

This work was supported by JSPS (KAKENHI 23-4376 and NEXT Program), MEXT (Innovative Area “Topological Quantum Phenomena”) and AFOSR-AOARD. KE expresses his special thanks for the Research Fellowship for Young Scientists by JSPS.

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Date submitted: 10 Nov 2011 Electronic form version 1.4