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STM/S studies of BiSbTeSe2 alloys: Intrinsic topological insulators with robust Fermi level in the bulk band gap HYOUNGDO NAM, Department of Physics, University of Texas at Austin, Austin, Texas 78712, USA, YANG XU, IRENEUSZ MIOTKOWSKI, JIFA TIAN, YONG CHEN, Department of Physics and Astronomy, Purdue University, West Lafayette, IN 47907, USA., CHIH-KANG SHIH, Department of Physics, University of Texas at Austin, Austin, Texas 78712, USA. — Topological insulators (TI) have been attracting a lot of interest in spin chiral topological surface state (TSS). One of the major material challenges has been the difficulty to create a topological insulator with true insulating bulk so that the topological surface states dominate the transport properties. There has been effort in creating the quaternary compounds, $Bi_{2-x}Sb_xTe_{3-y}Se_y$ (BSTS) with intrinsic bulk states. Namely the Fermi level is inside the bulk band gap with Dirac point also in the bulk band gap. Angle resolved photoemission has been used to show that 1112 compound, $Bi_1Sb_1Te_1Se_2$, possess this desirable property. Recent observation of topological surface state quantum Hall effect in this compound marks another important milestone. This work focuses on investigations of the electronic structure of $BiSbTeSe_2$ using scanning tunneling microscopy and spectroscopy (STM/S). With the second derivative of tunneling current, we accurately observed the locations of Dirac point (DP), valence band maximum point, and conduction band minimum point, which consist with previous ARPES studies. The investigation confirms the intrinsic bulk states with Fermi level is very close to the DP. We will further discuss the potential correlation of the DP fluctuation with respect to the local compositional fluctuations.

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