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High-mobility surface states and conductance fluctuations in Bismuth Telluro-Sulfide topological insulator devices TANUJ TRIVEDI, SUSHANT SONDE, HEMA C. P. MOVVA, SANJAY K. BANERJEE, Microelectronics Research Center, The University of Texas at Austin — Since the experimental discovery of three-dimensional topological insulators (TI), $(Bi,Sb)_2(Se,Te)_3$ binary compounds are the principal material systems to explore TI physics. However, transport experiments studying surface-states are complicated by parallel bulk conductivity contribution, which is expected to improve for ternary and quaternary chalcogenide compounds of Bi and Sb. A promising alternative is the Sulfur-based tetradymite with an ideal formula of Bi_2Te_2S, which has received little attention. We present van der Waals epitaxial growth and magnetotransport in Bismuth Telluro-Sulfide (BTS) crystalline nanosheets. Gating-enhanced Weak-antilocalization (WAL) and Universal Conductance Fluctuations (UCF) are observed in BTS devices. Empirical modeling of the data shows the existence of two-dimensional surface transport. A three-channel Hall conductivity model is proposed, which is utilized in conjunction with an extended-WAL analysis, showing the presence of a high-mobility surface component and indication for separation of transport channels in BTS devices. Our growth and comprehensive transport experiments demonstrate BTS as a promising candidate TI material.

Tanuj Trivedi
Microelectronics Research Center, The University of Texas at Austin

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