MATERIALS SCIENCE AND ENGINEERING

SEMINAR

"Dislocations in Topological Insulators: A Roadmap to Ideal Quantum Wires?"

by

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ABSTRACT

Materials that exhibit a forbidden electronic gap in the bulk yet contain electronic surface states which traverse the gap comprise a unique phase of matter given the nomenclature topological insulators. Experimental realization of these materials was first seen in $Bi_{0.9}Sb_{0.1}$ alloys. The topology of these materials leads to metallic conduction at their surfaces involving electrons that are not susceptible to non-magnetic impurity scattering. Previous theoretical work has shown that one-dimensional line defects within such topological insulators can provide a "surface-like" state within the bulk of the material, and thus are promising candidates for atomic-scale wires that preserve both spin and charge during transport. I propose an experiment utilizing atomic layer growth and strain engineering to nucleate controlled misfit dislocations at specific separation distances within the topologically insulating Bi_2Te_3 and Sb_2Te_3 interface. A demonstration that edge dislocations within this material system will satisfy the criterion necessary to realize a one-dimensional topological insulating state is presented. In addition, a series of characterization techniques are proposed to validate the success of the experiments.

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