Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Pulsed Laser Deposition of Epitaxial Topological Insulator Thin Films: Bi_2Te_3 and Bi_2Te_2Se SHIXIONG ZHANG, LI YAN, JINGBO QI, MUJIN ZHUO, Center for Integrated Nanotechnologies, Los Alamos National Laboratory, YONGQIANG WANG, Materials Science and Technology Division, Los Alamos National Laboratory, ROHIT P. PRASANKUMAR, QUANXI JIA, S. TOM PICRAUX, Center for Integrated Nanotechnologies, Los Alamos National Laboratory — While high quality epitaxial thin films of topological insulators have been achieved by molecular beam epitaxy, there has been little progress using other thin film growth techniques. Here, we report the growth of high quality epitaxial Bi_2Te_3 and Bi_2Te_2Se thin films on silicon (111) and YSZ (111) substrates by pulsed laser deposition (PLD). Systematic structural characterization of the films using x-ray diffraction and transmission electron microscopy has demonstrated that a low laser pulse rate is the key to achieving high quality epitaxial films. Rutherford backscattering spectrometry measurements suggest that the film composition is strongly influenced by the growth temperature and background gas pressure. The electrical transport properties of the films grown at the optimal conditions will also be discussed. Since PLD is an excellent tool to grow a variety of functional oxides, including multiferroics, magnetic semiconductors and high temperature superconductors, the growth of epitaxial topological insulator thin films by the same technique paves the way to synthesize multi-layered heterostructures of the above materials and search for novel physics arising from the resulting interfacial couplings.

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Date submitted: 11 Nov 2011 Electronic form version 1.4