Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Efficient Dual-Gate Tuning of Fermi Level in Thin-Film Topological Insulator[1] ALEXEY TASKIN, FAN YANG, SATOSHI SASAKI, KOUJI SEGAWA, YASUHIDE OHNO, KAZUHIKO MATSUMOTO, YOICHI ANDO, Osaka University, ISIR TEAM — Experimental studies of novel quantum phenomena predicted for three-dimensional (3D) topological insulators (TIs) often require tuning of the Fermi level across the Dirac point. Both back gating and top gating techniques have been successfully applied to 3D TI thin films, however, with a single gate the chemical potential of only one surface can be controlled effectively, which is not sufficient for many applications. Recently, we have succeeded in developing a comprehensive method for fabricating dual-gated devices on TI thin films grown by molecular beam epitaxy. The method combines 1) the transfer of a high-quality bulk-insulating $(Bi_{1-x}Sb_x)_2Te_3$ thin film grown on sapphire onto a Si/SiO_2 wafer, which serves as a back gate, and 2) the fabrication of a top gate by using a low-temperature deposition of SiN_x. We demonstrate that the dual gating allows effective tuning of the chemical potentials of the top and bottom surfaces across the Dirac point, which is manifested in a large peak of the sheet resistance accompanied by a sharp sign change of R_{yx} upon sweeping the top and bottom gate voltages. This dual-gating method opens exciting opportunities for realization of various novel phenomena expected for 3D TIs.

[1]Supported by JSPS (KAKENHI 25220708 and 25400328), MEXT (Innovative Area "Topological Quantum Phenomena" KAKENHI), AFOSR (AOARD 124038), Inamori Foundation, and the Murata Science Foundation.

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Date submitted: 12 Nov 2014 Electronic form version 1.4