

CMP Seminar Michigan State University

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Electrically controlled surface magnetism

Manipulation of magnetically ordered states by electrical means is among the most promising approaches towards novel spintronic devices [1-4]. Indeed, voltage control of magnetism is a “holy grail” of spintronics. Electric control of the exchange bias can be realized when the passive antiferromagnetic pinning layer, in an exchange bias system, is replaced by a magneto-electric antiferromagnet [3]. In a magneto-electric material, an applied electric field induces a net magnetic moment. Surprisingly this net magnetic moment, at the surface of a magneto-electric antiferromagnet, can be observed in spin-polarized photoemission [3], spin-polarized inverse photoemission [4], X-ray circular dichroism [4] and spin polarized low energy electron microscopy [5], when the antiferromagnetic single domain state is selected in a magneto-electric annealing process. In the single domain antiferromagnetic state of Cr_2O_3 , a magnetic $\text{Cr}_2\text{O}_3(0001)$ surface moment evolves which is robust against surface roughness. This has led to revived interest in the prototypical magneto-electric Cr_2O_3 , where spontaneous ferroelectric order is absent, but a specific surface magnetic order enables electric control of a net spin polarization of the $\text{Cr}_2\text{O}_3(0001)$ surface. Time permitting, some indication will be provided of the how magneto-electrics might be implemented into voltage controlled nonvolatile spintronic devices.

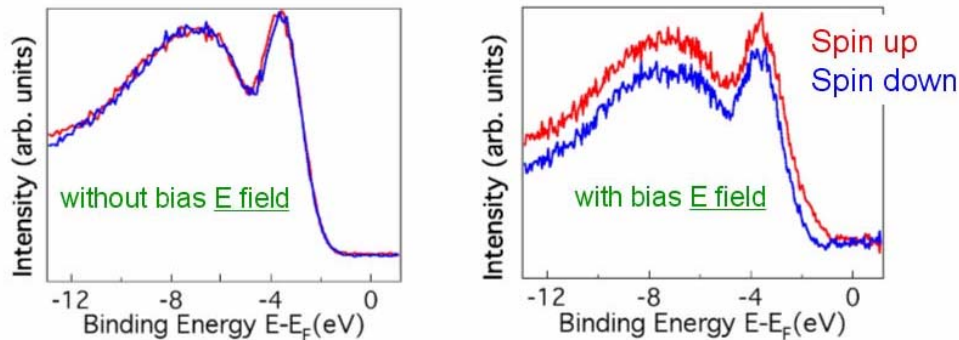


Fig. 1: Photoemission data from a $\text{Cr}_2\text{O}_3(0001)$ film before (left figure) and after magneto-electric annealing (right figure). In the antiferromagnetic single domain state, a net surface magnetization evolves which in turn gives rise to the spin splitting in the spin polarized photoemission data.

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Financial support provided through the Semiconductor Research Corporation through the Center for Nanoferric Devices, an SRC-NRI Center under Task ID 2398.001, and by C-SPIN, part of STARnet, a Semiconductor Research Corporation program sponsored by MARCO and DARPA and the Nebraska MRSEC. This work has been undertaken with Shi Cao, Ning Wu, Mike Street, A. Wysocki, U. Lanke, T. Komesu, W. Echtenkamp, Xi He, Yi Wang, A.N. Caruso, E. Vescovo, K.D. Belashchenko, K. Schmid, A.T. N’Diaye and Christian Binek,

Monday, March 21, 2016
4:10 p.m.BPS 1400
Prof. David Tomanek - Host