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Ferromagnetism in MgO by Nitrogen Doping CHENG-HAN YANG, MAHESH SAMANT, STUART PARKIN, IBM Almaden Research Center — The new group, dilute ferromagnetic oxide and nitride, provides a promising technology potential to combine the magnetic and electronic properties. Studies in creating ferromagnetism in thin films of doped oxide materials without the inclusion of transition metal (TM) or rare-earth (RE) metal have been speculated in recent years. However, there have been many reports of ferromagnetism in large numbers of different material systems with poor control and reproducibility of these data. Our interest is exploring the possibility of ferromagnetism in oxide and nitride films without the introduction of any TM or RE elements. In this study, we have successfully incorporated substantial amounts of nitrogen upto 13 at% into MgO films using molecular beam expitaxy (MBE) technique. N-doped MgO films were carried out by evaporating the Mg in the presence of both atomic oxygen and nitrogen from two different RF sources. Upon the post-annealing, N atoms generate holes on oxygen and so create magnetic moment as high as 0.4 μB/per N. In undoped MgO films, no magnetic signature was seen either in the as-deposited film or the film after annealing, which is a strong indication that the moment arises from the N dopants. The pre-edge feature of oxygen K-edge measured in Near Edge X-ray Absorption Fine Structure (NEXAFS) shows apparent evidence for the substitution of nitrogen for oxygen after post-annealing.

Cheng-Han Yang
IBM Almaden Research Center

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