

Title: Distinguished Lecture Series: A New Paradigm for Exchange Bias in Polycrystalline Films

Speaker:

Prof. Kevin O'Grady
The University of York,
United Kingdom

Date: Thursday, 8 July 2010

Time: 10:30 am

Venue: Room 603, Chow Yei Ching Building

Abstract:

The phenomenon of exchange bias has remained something of a mystery since it was discovered in core-shell particles in 1956 [1]. Over the subsequent years many different models have been proposed to explain this effect, most of which agree with some experimental data that can be found in the literature. No single theory, however, has been able to explain the data consistently for different systems. In this lecture the reason for our inability to explain exchange bias will be reviewed, and a new paradigm to explain the phenomenon in sputtered polycrystalline films will be presented. This new paradigm is based on an original granular model described by Falcomer and Charap [2]. Its premise is that very careful thermal and magnetic cycling is required to ensure that the order in the antiferromagnetic grains is controlled. Without such careful control, reproducible data cannot be obtained. These time-consuming and complex measurement procedures, to which we refer as the York protocol, have been developed over the last 9 years. Using the York protocol and an extension of the former granular model, effects such as the film thickness dependence and grain size dependence of exchange bias can be fully explained with an excellent fit between theory and experiment [3]. The York protocol also allows for the measurement of the anisotropy constant of antiferromagnetic grains [4]. This model provides an understanding of the behavior of the individual antiferromagnetic grains in detail. Since the behavior of the "bulk" of the antiferromagnetic grains is now known, preliminary data describing the behavior of the interface spins can now be distinguished from the behavior of the bulk. Possible mechanisms for the behavior of the interfaces themselves will also be presented.

Biography of the speaker:

Prof. K O'Grady received the Ph.D. in physics from The University of Wales in Bangor. He was a junior professor at Loughborough University of Technology and subsequently in the School of Electronic Engineering at Bangor, where he achieved a full professorship. In 2000 Prof. O'Grady relocated to the Physics Department at The University of York. Prof. O'Grady has published over 250 refereed works on the subject of magnetization reversal. He is a former president of the IEEE Magnetics Society and an editor of The Journal of Physics D: Applied Physics. He has been associated with the Intermag Conference as Program Committee co-chair in 1996, 2002 and 2008, and will serve as the general chair of the 2010 Joint MMM-Intermag Conference. He is the founding director of the York Materials Research Institute.

Organizer: Dr. P.W.T. Pong