MM 19: SYM Thin Film Magnetic Materials: Microstructure, Reaction and Magnetic Coupling II

Time: Tuesday 11:30–13:00 Location: H 0107

Invited Talk MM 19.1 Tue 11:30 H 0107

Atom Probe Characterization of Magnetic Thin Film Structures — •David Larson — Imago Scientific Instruments, Madison, WI USA

Improvements in the properties of nanoscale devices based on giant magnetoresistance or tunnel magnetoresistance depend on the capabilities of researchers to design, fabricate, and test such devices. Optimization of these capabilities are intimately tied to the feedback provided by the quality and quantity of available microscopic characterization. This work presents examples of the use of atom probe tomography to investigate microstructure for a variety of nanomagnetic thin film structures including multilayers, spin valves and tunnel barriers. Examples of interface characterization methods including a discussion of buried interface "roughness" will be given. Comparison of interfacial nature of experimental atom probe data and molecular dynamics simulation of thin film growth of a CoFe/Cu layered structures will also be presented.

Invited Talk MM 19.2 Tue 12:00 H 0107

Thermal stability and reaction of GMR sensor materials — •Vitaliy Vovk[1], Constantin Ene[2], and Guido Schmitz[3] — [1]Department of materials, University of Oxford, Parks Road 3PH, U.K. — [2]Institut für Materialphysik, Univ. Goettingen, Friedrich-Hundt-Platz 1, 37077 Göttingen, Germany — [3]Institut für Materialphysik, WWU Muenster, Wilhelm-Klemm-Str. 10, 48149 Muenster, Germany

State-of-the-art GMR sensors usually consist of thin film multilayers with a periodicity of a few nanometers only. The significant contribution of interfaces makes these nano-scaled materials inherently unstable. In the talk, the stability and thermal reaction of Py/Cu (Py stands for Ni81Fe19) and Co/Cu magneto resistive systems is addressed.

Thin film multilayers are analysed by wide angle atom probe tomography (WATAP). The different thermodynamics of the studied systems causes different mechanisms of GMR degradation. In the Py/Cu system, GMR deterioration occurs due to short range mixing at the layer interfaces, caused by gradient energies and quantitatively described by Cahn-Hilliard theory. In contrast, this mechanism is not observed in Co/Cu multilayers up to temperatures of 450°C. Instead, ferromagnetic bridges along grain boundaries through Cu appear at even higher temperatures.

Besides the mixing reaction, a recrystallization transforming the layer texture is observed in both metallic systems. Elasto-mechanic calculations demonstrate that this transformation is due to elastic anisotropy.

Invited Talk MM 19.3 Tue 12:30 H 0107

Solid state reactions at the interface of Heusler alloy films — •Hans-Joachim Elmers[1], Andres Conca[1], Tobias Eichhorn[1], Andrei Gloskovskii[2], Kerstin Hild[1], Gerhard Jakob[1], Martin Jourdan[1], and Michael Kallmayer[1] — [1]Institut für Physik, Johannes Gutenberg-Universität, D-55099 Mainz, Germany — [2]Institut für Anorganische und Analytische Chemie Johannes Gutenberg-Universität, D-55099 Mainz, Germany

Magnetic and structural properties on a nanoscale are of vital interest for data storage and actuator applications of magnetic thin films. Half-metallic Heusler alloy films offer new routes for the development of devices based on spin transfer mechanisms. Ferromagnetic shape memory alloy films provide potential applications exploiting their huge magnetically induced length change. The control of interface properties of these complex alloys is crucial for future applications. We show that x-ray absorption spectroscopy can be used as an efficient tool for the determination of element-specific magnetic and structural properties both in the bulk and at buried interfaces. We present results for the variations of orbital and spin moments at the martensitic phase transition of Ni_2MnGa. As an example for the modification of interface properties, we present results on the solid-state reaction at the interface of Heusler alloys and Al. Micro-spectroscopy using photoemission electron microscopy (PEEM) reveals an inhomogeneous interface reaction with reaction nuclei separated on a micron length scale.