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Amorphous magnetic films

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Spintronics (Spin transfer electronics) was introduced by S A Wolf in 1996 as the name of a DARPA project to develop both a non-volatile magneto resistive random access memory (MRAM) and also magnetic sensors for specialized applications. Today, spintronics has already shown promise in ultra-low power and non-volatile information processing and data storage technology. Recent advance in spintronic material systems will be reviewed. For the rest of my talk, we focus on amorphous rare-earth-transition-metal (*a*-RE-TM) thin films that exhibit perpendicular magnetic anisotropy (PMA). *a*-RE-TM are ferrimagnets with two ferromagnetic RE and TM sublattices that interact via antiferromagnetic exchange coupling. These amorphous ferromagnetic films exhibit large coercivity fields of several Tesla and anisotropy energy was near 10^6 erg/cm. The magnetization of the sub lattices compensates each other at the compensation temperature (T_{comp}). The role of strain and magnetostriction will be discussed. These materials also exhibit ultrafast magnetic dynamics (switching) and are being studied for high-density ultrafast nanoelectronics. Due to the unusual atomic scale structure and wide compositional range of these amorphous films, novel magnetic states can be obtained by appropriately configuring the nanoscale structure of the thin film. The mechanisms involved can be verified by micromagnetic and atomistic simulations. Measurements include magnetization, MOKE, MFM, Hall effect, and magneto-resistance. The ability to control these new properties in amorphous films without the need for epitaxial growth could open a new avenue for enhancing the functionalities of spin-based materials.

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