NCNR SEMINAR: OCTOBER 24, 2024. 10:45 AM (EST)

High Entropy Materials with High Magnetic Anisotropy

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High anisotropy materials have critical importance in permanent magnets, magnetic recording media, and spintronics, however their reliance on rare-earth and precious metals is a longstanding concern for sustainability. While the search for new rare-earth-free high anisotropy materials has exhausted much of the pool of binary and ternary alloy compositions, entropy-stabilization in high entropy materials (HEMs) affords a vast number of unique and unexplored electronic structures potentially favorable to high magnetic anisotropy. Conventional high entropy alloys exhibit uniform chemical disorder and cubic crystal structures, whereas long-range chemical order and low-symmetry crystal structures play important roles in magnetic anisotropy. In my talk I will present on design and fabrication strategies to realize magnetic HEMs with intermetallic sublattices and uniaxial symmetry, and explorations of their magnetic properties throughout the composition space. We start by demonstrating a fabrication approach based on sputtering and rapid thermal annealing (RTA) in FeCoNiMnCu thin films, which show an almost 40-fold increase in coercivity from the as-grown state. Next, inclusion of 50 at.% Pt in the film leads to ordering of a single L10 high entropy intermetallic phase after RTA, along with development of a large perpendicular anisotropy and 3-orders of magnitude increase in coercivity. Finally, we explore the composition space of C16 phase 3d transition metal borides using a combinatorial approach, leading to discovery of a novel high anisotropy composition beyond the binary and ternary borides.

Thursday, October 24, 2024

10:45 AM (UTC-05:00) Eastern Time (US & Canada) | Hybrid format

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