Broadening the Design Space of Rare-earth-free Permanent Magnets Using Advanced Processing Routes applications

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Materials processing is a critical component of Materials Science & Engineering. How a material is shaped into its final form is essential to a material's structure (i.e., crystallographic structure, phases, microstructure, macrostructure) and, therefore, to its properties & performance. It is also critical in determining the final product's functionality and is central to materials selection and design. Within this context, the **overarching mission** of the Advanced Magnetic Materials Processing AM²P laboratory at Virginia Commonwealth University is to engage in fundamental studies of microstructure to develop advanced functional magnetic materials with unprecedented functional performance.

In this talk, I will discuss how the AM²P research group implements the use of advanced materials processing methodologies and a diverse set of cutting-edge experimental characterization techniques to examine relationships between processability, materials structure, and functional response at different hierarchical length scales in rare-earth-free permanent magnets – a group of highly magnetized functional hard materials which do not lose magnetism over time due to the generation of the magnetic field by the internal structure of the material itself. The presentation will mainly focus on two types of permanent magnet alloys – **(1)** Alnico alloys - a phase-separated nanocomposite so-called due to their majority composition of aluminum, nickel, iron, and cobalt and **(2)** Tetrataenite – a chemically ordered $L1_0$-type FeNi phase found only in meteorites in its native state. The end goal of these research efforts is to support innovative applications in the energy sector while improving the energy security of the United States by reducing imports of critical raw materials and energy from foreign sources.

Biography: Radhika Barua is an Assistant Professor in the Department of Mechanical and Nuclear Engineering in the College of Engineering at Virginia Commonwealth University in Richmond, VA. She holds a Ph.D. and M.S. degree in Chemical Engineering (specializing in Materials Science) from Northeastern University and a B.E. degree in Chemical Engineering from Visveswaraiah Technological University in India. Her research interests focus on developing advanced functional magnetic materials and devices for diverse applications in the power and energy sector, including magnetic refrigerators, thermal energy harvesting devices, sensors/actuators for harsh environments, and permanent magnets. Currently, she has over 45 peer-reviewed publications and three patents. Her research is supported primarily by the National Science Foundation, the Commonwealth Cybersecurity Initiative CCI, and the VentureWells Foundation. In service to the scientific community, she serves as the Chair of the Richmond Chapter of the IEEE Magnetics Society and on the Technical Advisory Board of the Commonwealth Center for Advanced Manufacturing.