

School of Materials Science and Engineering



**Seminar Topic:
Sustainable Magnetic Materials**

Professor Raju V. Ramanujan

Abstract

Sustainability is a key focus of current R & D interest throughout the world. Conventional magnetic cooling materials use rare earth materials. However, heavy rare earth materials are classified as “critical” materials due to strategic instability in supply, price fluctuations, hazardous mining issues etc. This leads to serious sustainability concerns. Hence, we studied novel rare earth free materials for thermal management and energy harvesting. We have developed autonomous and self-regulating magnetic cooling heat pipes using rare earth free ferrofluids. These heat pipes exhibit high performance for cooling in the kW range, high heat load temperatures and transfer heat efficiently over long distances. We have also fabricated a solid state, rare earth free, combined magnetic cooling and energy harvesting system.

There is an urgent unmet need for sustainable components exhibiting locally optimized properties, such components will minimize materials use. Combinatorial synthesis of compositionally graded structures is very useful to rapidly identify compositions possessing this locally optimized property set. We used combinatorial synthesis to develop low coercivity, mechanically strong, magnetic materials for high frequency electrical motors. We processed rare earth free compositionally graded magnetic structures by laser engineered net shaping (LENS) additive manufacturing. Quick materials assessment, including the use of AI/Machine Learning, was used to identify the most promising composition, structure and property set. Our results are beneficial to develop net shape, complex geometry components with locally optimized properties.

Biography

Prof Raju V. Ramanujan is Assistant Chair (Graduate Studies), School of Materials Science and Engineering, Nanyang Technological University, Singapore. He earned his undergraduate and PhD degrees from IIT-Bombay and Carnegie Mellon University (USA) respectively. He is a Fellow of the American Society for Materials. He has served on the Functional Materials Divisional Council, Magnetic Materials Committee (Chair), Phase Transformations Committee and Awards Committees of TMS (USA). He was the Chair of the IEEE INTERMAG conference and is an IEEE Technical Committee member. Prof Ramanujan serves in an Editorial capacity for Scientific Reports (Nature Publishing Group), Nanomedicine, Metallurgical and Materials Transactions, Materials Science and Engineering B, and Materials Science and Engineering C. He has received the Nanyang Award for Excellence in Teaching and the Rolls Royce Inventors award. He is a Guest Professor at South China University of Technology, University of North Texas, Indian Institute of Technology and Mumbai University.

His research interests include accelerated materials development and magnetic nanotechnology for sustainability, energy, bio X and Lab-on-a chip systems.

Wednesday, 16 October 2019 || Time: 2:00 pm – 3:00 pm
Venue: MSE Meeting Room (N4.1-01-28)
Hosted by: Associate Professor Zhao Yang