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Hysteresis Design of Magnetic Materials for Efficient Energy Conversion

Tuesday, 18 January 2022, 9:00 s.t., TU Darmstadt, Zoom



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Zoom information
Meeting-ID: 825 8716 0170
Kenncode: 212740

Tuning the hysteresis of magnetic materials by microstructure engineering

Abstract:

Magnetic materials are essential component for the green energy conversion and data storage and they play critical role toward realization of carbon neutral society. It is known that engineering of hysteresis lead to different functionality in the magnetic materials; i. e. realizing a large magnetic hysteresis is desired for permanent magnets and FePt granular media while reduction of hysteresis is needed for soft magnets and magnetocaloric materials. In this talk, I will present how we tune the hysteresis of functional magnetic materials by alloy and microstructure design. In the first part of presentation, I will show our recent success in realizing a sufficiently large coercivity of 1.0 T in rare-earth lean SmFe₁₂-based anisotropic magnets assisted by machine learning [1-3]. Based on detailed microstructure characterizations and micromagnetic simulations, I will discuss the optimum microstructure which can lead to a larger coercivity and remanent magnetization in the anisotropic bulk sintered SmFe₁₂-based magnets. In the second part of my talk, I will present our research activity on development of hysteresis free magnetocaloric materials with a large magnetocaloric effect for the cryogenic magnetic refrigeration applications [4].

[1] H. Sepehri-Amin et al. Acta Mater. 194 (2020) 337.

[2] X. Tang et al. Scripta Mater. 200 (2021) 113925.

[3] J. S. Zhang et al. Acta Mater. 217 (2021) 117161.

[4] J. Lai et al. Acta Mater. 220 (2021) 117286.

About the speaker:

Navid H. Sepehri-Amin is a material scientist working as a principal researcher at National Institute for Materials Science (NIMS), Tsukuba, Japan. He is also associate professor at Tohoku University. He earned his Ph.D. in material science and engineering from the University of Tsukuba in 2011. His research interest is about magnetic materials, multiscale microstructure characterizations using electron microscopy and atom probe tomography, as well as micromagnetic simulations.