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Hysteresis Design of Magnetic Materials for Efficient Energy Conversion

Tuesday, 26 October 2021, 15:00 s.t., TU Darmstadt, Zoom

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Zoom Information:
Meeting-ID: 827 8534 6731
Kenncode: 068868

On the Trail to Tetrataenite - Evaluating its potential for permanent magnet applications

Abstract:

21st-century aspirations for e-mobility, robots and drones require advanced permanent magnets which will approach an estimated 2027 market value of $36.9 billion[1]. While the rare-earth "supermagnets" are excellent for these applications, demand is predicted to outstrip supply within a decade, motivating the search for new types of magnetic materials. One contender is the iron-nickel meteoritic mineral known as "tetrataenite"[2,3] that could provide a magnetic energy product (BH)max in excess of 300 kJ/m3, ideal for so-called "gap magnet" applications. While comprised entirely of sustainable and easily accessible elements, tetrataenite, however, takes up to a billion years to form in nature. Terrestrial synthesis of tetrataenite-based magnets has the potential to revolutionize technology and upend geopolitically influenced supply chains.
Addressing this challenge, enhancing the formation of tetrataenite has been rationally approached through the application of multiple thermodynamic drivers applied during processing. This presentation will introduce new results that point to stabilization of tetrataenite resulting from this specialized processing treatment. Additionally, novel processing methods that are anticipated to further accelerate the formation of tetrataenite will be presented and discussed. Overall, these concepts support the case that attainment of L10 FeNi may be possible on earthly timescales.

1. https://magneticsmag.com/permanent-magnet-market-will-rise-to-nearly-37-billion-by-2027/
2. L.H. Lewis et al., J. Phys.: Condensed Matter 26 (6) 2014.
3. Kovács, András, et al. Nano Letters (2021).

About the speaker:

Laura H. Lewis is the Distinguished University and Cabot Professor of Chemical Engineering and Professor of Mechanical and Industrial Engineering at Northeastern University in Boston, MA. Prior to her Northeastern University position, she was a research group leader and Associate Department Chair in the Nanoscience Department of Brookhaven National Laboratory (BNL). Concurrently, she was the Deputy Director of the BNL Center for Functional Nanomaterials, a national user facility to provide researchers with state-of-the-art capabilities to fabricate and study nanoscale materials. Laura earned her Ph.D. in Materials Science and Engineering from the University of Texas at Austin under the guidance of John Goodenough (2019 Nobel Laureate, Chemistry); she received a M.S. degree in Electronic Materials from M.I.T. and holds a B.S. degree in Physics and Earth Sciences from the University of California at San Diego.

Laura's research focuses on investigating the materials factors at the atomic level that provide functionality to magnetic and electronic materials. She has authored over 200 peer-reviewed publications and delivered over 100 invited presentations at national and international venues.