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Hysteresis Design of Magnetic Materials for Efficient Energy Conversion

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Zoom information:
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Alloy development and emerging processing routes of soft and hard magnetic materials

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Abstract:

World-wide there is a tremendous demand for more efficient and sustainable magnetic materials to reduce energy and natural resource consumption as well as gas emissions. The exceptional technological relevance of some novel magnetic compositions is in some cases only limited by technical barriers related to the lack of industrial production routes to obtain magnetic components of large dimensions and of complex geometries. In this talk we will discuss emerging manufacturing routes and alloy design for obtaining the next generation soft- and hard- magnetic materials. Selected research topics include: development of new glass forming soft-magnetic compositions in the system Fe-Si-B for additive manufacturing routes[1,2,3] and direct extrusion routes of permanent magnets based on Nd-Fe-B to imprint radial anisotropy[4,5]. Both examples highlight the critical link between microstructure engineering and imprinted magnetic properties and offer insights to enhance energy efficiency in electrical applications.

References:

[1] L. Thorsson, M. Unosson, M.T. Pérez-Prado, X. Jin, P. Tiberto, G. Barrera, B. Adam, N. Neuber, A. Ghavimi, M. Frey, R. Busch, I. Gallino, *Selective laser melting of a Fe-Si-Cr-B-C-based complex-shaped amorphous soft-magnetic electric motor rotor with record dimensions*, **Materials and Design**, 215 (2022) 110483
DOI: https://doi.org/10.1016/j.matdes.2022.110483

[2] M. Rodríguez-Sánchez, S. Sadanand, A. Ghavimi, R. Busch, P. Tiberto, E. Ferrara, G. Barrera, L. Thorsson, H.J. Wachter, I. Gallino, M.T. Pérez-Prado, *Relating laser powder bed fusion process parameters to (micro)structure and to soft magnetic behaviour in a Fe-based bulk metallic glass*, **Materialia**, 35 (2024) 102111
DOI: https://doi.org/10.1016/j.mtla.2024.102111

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[4] A. Rüdiger, S. Gall, S. Müller, *Investigations into the processing and texture of Pr-substituted NdFeB magnets produced by extrusion*, **Materials Research Proceedings** 28 (2023) 505-514
DOI: https://doi.org/10.21741/9781644902479-55

[5] The work hereby presented has been carried out under the "WvSC – EA 2.0 Elektrische Antriebstechnik 2.0 " project, co-funded by the European Regional Development Fund (ERDF) and the federal state of Berlin. The authors thank the rest of the project partners for their involvement in the project. Website: https://wvsc.berlin/projekt/profit-ea

About the speaker:

Isabella Gallino was educated in Italy and in the USA. She received a degree in Chemistry from the University of Turin and a Ph.D. degree in Materials Science and Engineering from the Mechanical Engineering department of the Oregon State University. In 2005, she moved to Saarland University in Germany as a Group Leader and pursued her Habilitation in the field of Metallic Glasses.

In January 2024, she joined the Technical University of Berlin as Full Professor leading the Chair of Metallic Materials and the Research Center of Extrusion.

Her research interests are in the field of physical metallurgy and include both fundamental science and technical aspects, such as the thermophysical properties of bulk metallic glass-forming liquids and the development of innovative metal processing techniques and the discovery of new alloy compositions for commercial applications.