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Hysteresis Design of Magnetic Materials for Efficient Energy Conversion

Tuesday, 28 January 2025, 9:00 s.t., TU Darmstadt and via Zoom



Prof. Dr. Gerhard Schneider
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Hochschule Aalen

Artificial Intelligence in Permanent Magnet Research and Development – Intrinsic Magnetic Properties and Microstructure Analysis

Abstract:

The intrinsic properties of the phases present and the microstructure determine the properties of functional materials.

In FeNdB permanent magnets, the main phase is the 14:2:1 phase. Other elements, which can substitute Fe, Nd or B in the ternary phase to some extent, modify the intrinsic magnetic properties. We have developed regression models to predict the density, the Curie temperature as well as the saturation magnetization and the anisotropy constant at room temperature of 14:2:1 phases from the chemical composition as input features.

Artificial intelligence approaches are also helpful in characterizing the microstructure of sintered FeNdB magnets. Several different tools have been developed for digital image enhancement, phase segmentation, grain size analysis, analysis of crystal orientation of grains and defect detection.

About the speaker:

Studied metallurgy at the University of Stuttgart. Diploma thesis and PhD at the Max-Planck-Institute for Metals Research, Stuttgart. 1988/89 Professor Visitante at the University of São Paulo, Institute of Physics, Brazil. 1989 to 1996 project and group manager at Robert Bosch GmbH in Stuttgart in Corporate Research. 1996 to 2001 professor in Materials Science at Aalen University. 2001 to 2005 head of the Materials Research at Bosch in Stuttgart. 2005 to 2008 head of Bosch Research America, Palo Alto, CA, USA. 2008 to 2021 President of Aalen University. Gerhard Schneider is a co-opted professor in the Faculty of Mechanical Engineering at the Karlsruhe Institute of Technology (KIT) Currently, he is director of the Materials Research Institute Aalen and conducts research in the fields of materials analysis, functional materials, additive manufacturing, and machine learning.

Zoom information:

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