



CRC/TRR 270

HoMMage



UNIVERSITÄT  
DUISBURG  
ESSEN

Offen im Denken

**Hysteresis Design of Magnetic Materials for Efficient Energy Conversion**

**Tuesday, 05 December 2023, 9:00 s.t., UDE, in Person and via Zoom**



**Dr Varun Chaudhary**  
**Industrial and Materials Science**  
**Chalmers University of Technology, Sweden**

## Additive manufacturing of magnetic materials

### Abstract:

The demand for high performance magnetic materials with high strength is gradually increasing due to their importance in energy conversion devices including electric motors, transformers, and generators. Traditional materials often face limitations and lack the desired properties required for the development of next generation e-vehicles and wind turbines. Additive manufacturing (AM) offers a promising solution by accelerating the development of novel materials, improving material utilization, and providing precise control over composition and microstructure. Compositionally graded Fe-xCo-yNi, Fe-xNi-ySi, and Fe-xSi alloys have been processed by AM technique known as direct energy deposition. The graded compositions result in a remarkable change in magnetic, mechanical, and electrical properties. For example, in Fe-Co-Ni alloy system, coercivity changes range from 0.4 to 64 Oe, resistivity from 9.4 to 72.6  $\mu\Omega\text{-cm}$ , and ultimate tensile strength from 465 to above 1150 MPa. Such tunable functionality graded properties offer unique potential for energy conversion applications specially for high-speed electric machines. Furthermore, this presentation will elaborate on additional high-throughput methods for discovering novel magnetic materials, such as combinatorial flow synthesis, spark plasma sintering, thermodynamic modeling, and machine learning.

### About the speaker:

Dr Varun Chaudhary is an assistant professor in the Department of Industrial and Materials Science at Chalmers University of Technology, Sweden. He received his Ph.D. from the Interdisciplinary Graduate School at Nanyang Technological University (NTU), Singapore. Previously, Dr. Chaudhary was a Senior Research Fellow at the School of Materials Science and Engineering at NTU, Singapore. He has also served as a DST Research Fellow at the National Physical Laboratory, New Delhi, and as a Research Scientist at Rolls-Royce Corporate Lab, Singapore. Dr. Chaudhary is an editorial board member of Scientific Reports, Nano, Materials Open, MRX, and IJMMM. He is also a member of MRS USA, IEEE, and MRS Singapore.

Dr Chaudhary's research is centred on a wide range of magnetic materials tailored for energy applications. His specific areas of interest include magnetocaloric materials, soft magnets, permanent magnets, high entropy alloys, functionally graded materials, accelerated materials development, additive manufacturing, artificial intelligence and machine learning.

CRC/TRR 270 • Technische Universität Darmstadt and Universität Duisburg-Essen  
Spokesperson: Prof. Dr. Oliver Gutfleisch • Co-Spokesperson: Prof. Dr. Michael Farle  
Management: Dr. Sonja Laubach • L2 | 07 107 • sonja.laubach@tu-darmstadt.de • +49 (0)6151 16-22153  
Address: CRC/TRR 270 • TU Darmstadt • Peter-Grünberg-Str. 16 • 64287 Darmstadt