"PERMANENT MAGNETS FOR ENERGY –

FROM FUNDAMENTALS TO APPLICATIONS"

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Due to their ubiquity, magnetic materials play an important role in improving the efficiency and performance of devices in electric power generation, conversion and transportation. Permanent magnets are essential components in motors and generators of hybrid and electric cars, wind turbines, etc., and improvements in magnetic materials will have a significant impact in this area, on par with many “hot” energy materials efforts (e.g. hydrogen storage, batteries, thermoelectrics, etc.). An increase in the magnetic energy density $(BH)_{max}$, increases the efficiency of the device making it smaller and lighter.

The lecture focuses on the state-of-the-art of permanent magnet concepts and materials with an emphasis on their optimization for energy applications. The synthesis, characterization, and property evaluation of the materials will be examined having in mind the critical micromagnetic length scales of the 3d-4f compounds. The principle processing routes for various types of magnets will be elucidated. Especially the structure-property relationships impacting on coercivity will be discussed.

Considering future bottle-necks in the rare earths and in the supply chain concepts for reduction and substitution will be explored. Using this example, the analysis of criticality of metals and their life cycle will be briefly introduced. Finally, options for recycling of rare-earth metals will be discussed (“from urban mine to magnet”).

O. Gutfleisch, J.P. Liu, M. Willard, E. Brück, C. Chen, S.G. Shankar, Magnetic Materials and Devices for the 21st Century: Stronger, Lighter, and More Energy Efficient (review), Adv. Mat. ***23*** *(2011) 821-842.*

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