



Symposia Summary

Magnetic Materials for Energy Applications

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This marked the first year that the symposium on Magnetic Materials for Energy Applications was organized under the sponsorship of the new TMS Magnetic Materials Committee. The symposium focused on various types of magnetic materials that can contribute to energy savings. Improved hard and soft magnetic materials, for instance, will improve the efficiency of electric energy \leftrightarrow mechanical work conversions in motors and generators. Advanced electric steels also improve the energy efficiency of electric vehicles. Advanced amorphous and nanocrystalline soft magnetic materials are of interest for inductors/transformers in high frequency power electronics. There is also a new type of energy related magnetic material—magnetocaloric materials—for novel, solid-state based and energy efficient refrigeration.

For electric vehicles and wind turbines, Neodymium (Nd)-based rare earth permanent magnets need to retain their properties up to moderately high temperatures, making the use of heavy rare earth elements such as Dysprosium (Dy) essential. However, due to recent concerns about the availability of heavy rare earth elements, the development of new high performance permanent magnets using less or no heavy rare earth is urgently required.

Three keynote lectures offered overviews of the main topics. George Hadjipanayis, University of Delaware, spoke about current strategies in designing high performance permanent magnets. Vitalij Pecharsky, Ames Laboratory, focused on the discovery of optimized magnetocaloric materials and Dr. Motoki Ohta, Hitachi Metals, presented promising high B_s nanocrystalline soft magnetic alloys prepared by rapid solidification. In addition, invited speakers from industries offered instructive talks on the industrial demands for magnetic materials. Shigeru Konda, Toyota, discussed the requirements of rare earth permanent magnets and electric steels for current and future hybrid/electric vehicles. Takehisa Minowa, Shinetsu Chemical, talked about the Dy diffusion process to enforce the local coercivity of Nd-based permanent magnets for large scale wind turbines. Satoshi Hirose, Hitachi Metals, introduced Japanese national projects focused on the development of Nd-based anisotropic nanocomposite permanent magnets, and Ichiro Tanaka, Sumitomo, updated symposium participants on the long-standing effort in improving the soft magnetic properties of electric steels for hybrid vehicles. Frank Johnson gave an overview on the demand of new soft magnetic materials for power electronics. The symposium program was rounded out by other invited and contributed talks that reported recent researches on processing, characterization, and property evaluation of hard, soft, and magnetocaloric materials, placing an emphasis on microstructure-property relationships.

The last day of the symposium featured a panel session on the requirements of magnetic materials for current technological applications. Panelists included Rajeev Ram, ARPA-E; Karl Gschneidner, Ames Laboratory; Takehisa Minowa, Shin-Etsu Chemical Co. Ltd.; Jinfang Liu, Electron Energy Corporation; Aru Yan, Ningbo Institute of Material Technology and Engineering; Dr. Francis Johnson, General Electric Global Research; Ryusuke Hasegawa, Metglas, Inc.; and Sarah Bedair, US Army Research Laboratory. Lake Shore Cryotronics Inc., AMT&C LLC, and the 147th Committee on Amorphous and Nanocrystalline Materials of the Japan Society for the Promotion of Science (JSPS) co-sponsored the symposium.

—Submitted by Victorino Franco