MA 19 Invited Talks Algarabel / Gutfleisch

Time: Tuesday 14:00–15:00 Room: HSZ 03

Invited Talk MA 19.1 Tue 14:00 HSZ 03

Pressure and magnetic field effects on the magnetic and crystallographic structures of the R5(SixGe1-x)4 compounds — •Algarabel P. A.[1], Morellon L.[1], Magen C.[1], Ibarra M. R.[1], Ritter C.[2], and Arnold Z.[3] — [1]Instituto de Ciencia de Materiales de Aragón, Universidad de Zaragoza and Consejo Superior de Investigaciones Científicas, 50009 Zaragoza, Spain — [2]Institut Laue-Langevin, Boîte Postale 156, 38042 Grenoble Cédex 9, France — [3]Institute of Physics AS CR, Na Slovance 2, 182 21 Prague 8, Czech Republic

The astonishing properties discovered in the R5(SixGe1-x)4 rare-earth intermetallic materials have triggered a great research activity due to an exceptional magnetoresponsive behavior such as the giant magnetocaloric effect , strong magnetoelastic effects, and giant magnetoresistance. This phenomenology has been associated with the intrinsically sub-nanometer-layered crystallographic structure combined with a magnetic-martensitic first-order phase transformation. The strong magnetoelastic coupling responsible for these phenomena allows the magnetic-crystallographic transition to be reversibly induced by the change of external parameters such as temperature, external magnetic field, or hydrostatic pressure. A review of the most outstanding properties arising from the strong interplay between the crystallographic structure and magnetism in the system R5(SixGe1-x)4 (R=Gd, Tb, Er) is presented. In addition to compositional and magnetic-field effects, we will emphasize the significance of the hydrostatic pressure as a new control parameter of the properties of these compounds.

Invited Talk MA 19.2 Tue 14:30 HSZ 03

Melt-spun materials for magnetic refrigeration near room temperature — •Oliver Gutfleisch — IFW Dresden, P.O. Box 270016, D-01171 Dresden, Germany

The development of giant magnetocaloric effect (MCE) materials could open the path for magnetic refrigeration near ambient temperature as an energy efficient, easily scaleable, mechanically simple and environmentally friendly cooling technology, by this replacing conventional refrigeration. Unlike in Gd5Ge2Si2, no magnetic-field induced crystallographic structural changes are involved in the large values of magnetic entropy change reported for LaFe13-xSix compounds of NaZn13-type structure and for MnFePAs compounds of Fe2P-type structure. LaFe11.8Si1.2 shows a thermally-induced first-order phase transition as well as an itinerant-electron metamagnetic transition accompanied by a significant volume change. A prolonged heat treatment is usually necessary to develop the NaZn13-phase in the bulk. Here, LaFe13-xSix was prepared by melt-spinning. Melt-spinning can yield refined microstructure, extended solute solubility, reduced macro- and micro-segregation and metastable phases. We succeeded in the preparation of the 1:13 phase by a much reduced annealing and in enhanced values of magnetic entropy changes. Curie temperature and the nature of the magnetic phase transition (shift from first-order to second-order) is adjusted by increasing Si content, by partially substituting Co for Fe or by interstitial hydrogen. These changes have not only consequences for the thermal and magnetic hysteresis but also affect the final net refrigerant capacity. A similar evaluation was done when replacing toxic As with Ge in melt-spun MnFePGe.