

Structure, Magnetism and Thermodynamics of Novel Rare Earth Based Intermetallic Materials

V.K. Pecharsky^{C, S}

*Ames Laboratory of the U.S. DOE and Department of Materials Science and Engineering, Iowa State University, Ames, IA, U.S.A.
vitkp@ameslab.gov*

After approximately 30 years of dormancy, the binary, ternary and multi-component intermetallic compounds of rare earth metals (R) with group 14 elements (T) at the R_5T_4 stoichiometry have become a goldmine for condensed matter physics, materials science and solid state chemistry. In addition to providing numerous opportunities to clarify elusive structure-property relationships, the R_5T_4 -based materials may soon be developed to practically exploit the unique sensitivity of these compounds toward a variety of chemical and physical triggers. Their uniqueness is in the bonding between the well-defined, self-assembled ~ 0.7 nm thick layers of atoms (slabs) and the resultant magnetic, transport, and thermodynamic properties of the R_5T_4 compounds that can be controlled by varying either or both R and T, including mixed rare earth elements on the R-sites and different group 14 (and 13 or 15) elements occupying the T-sites. In addition to chemical means, the interlayer interactions can be manipulated by temperature, pressure, and magnetic field. Presently, a substantial, yet far from complete, body of knowledge exists about the Gd compounds with T = Si and Ge. In contrast, only a little is known about the physics and chemistry of R_5T_4 alloys with R = Pr, Nd, Tb, and Dy, while compounds with the other rare earths and with T = Sn and Pb remain virtually unexplored.

This work is supported by the Office of Basic Energy Sciences, Materials Sciences Division of the U.S. Department of Energy under contract No. W-7405-ENG-82 with Iowa State University.