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Structure and Magnetic Properties of Rare-Earth Nickel Bismuthides $\text{RENi}_{0.6}\text{Bi}_2$ (RE = La,Ce, Pr,Nd,Gd)

Karishma Prasad

Faculty: Jian Wang

Department of Chemistry, Fairmount College of Liberal Arts & Sciences

In recent years, there has been a surge of interest in materials incorporating Bi square nets due to their intriguing properties, including characteristics such as Dirac behavior and the emergence of semi-topological features. In ternary bismuthides, depending on the transition metal (M) involved, significant variations in stoichiometry have been observed. This variation can occur due to either incomplete filling of the primary transition metal site, resulting in defective structures with less than the expected number of atoms ($\text{RE}M_{1-x}\text{Pn}_2$), or due to partial filling of an additional transition metal site, leading to structures with more atoms than expected ($\text{RE}M_{1+x}\text{Pn}_2$). My research work is on investigating the rare-earth-nickel-bismuth (RE-Ni-Bi) ternary system, with a particular emphasis on the structural characterization. Synthesis technique including solid-state reactions is employed to prepare RE-Ni-Bi compounds. Structural characterization is conducted using Powder X-ray diffraction (PXRD), Energy-dispersive X-ray spectroscopy (EDS) to elucidate the crystal structure and microstructural features of the synthesized phases. Arranged along the c-axis and interspersed by rare-earth (RE) atoms, layers consisting of square networks of Bi atoms alternate with tetrahedrally coordinated Zn atoms, with Bi atoms serving as the coordinating ligands. Overall, this research provides valuable insights into the synthesis, structural properties of rare-earth-nickel-bismuth ternary compounds, tuning the Ni vacancy and how it will change the bonding.