

Combining Crystallography and Complementary Techniques to Understanding Small Structural Changes in Intermetallic Compounds and Sulfides

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Crystallography is critical to our research interests in synthesis and structural determination of rare-earth based ceramics and intermetallic compounds. This talk will cover the characterization of both rare-earth sulfides and intermetallics. Recently, we have begun to explore RE-Cu-Ga (RE= La – Nd) compounds that crystallize in the NaZn_{13} structure type, which is known to host permanent magnetism, magnetocaloric effect and unconventional superconductivity. Single crystals of $\text{CeCu}_{6.09}\text{Ga}_{6.78}$ and $\text{NdCu}_{5.59}\text{Ga}_{7.29}$ have been prepared by the flux growth method. Single-crystal X-ray diffraction, electron microscopy and theoretical LMTO calculations were used to understand the stability of their crystal structures. RECa_2S_4 (RE=La – Nd) are potential pigment materials. Powder X-ray diffraction and electron microscopy methods were used for the first time to show that these materials could be made without the flow of toxic gases. Structural characterization and elemental composition studies are also critical to understanding a possible metal-insulator transition.