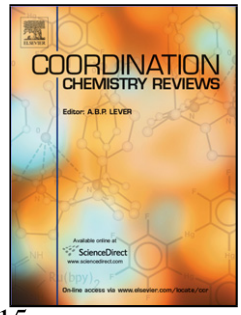

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Evaluation of *f*-Element Borate Chemistry

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Abstract

The synthesis, structure elucidation, and spectroscopic measurements of a myriad of new, *f*-element borates has revealed the unusual effects that this electron-rich oxoanion has on the electronic properties of lanthanides and actinides. One purpose of these studies was to provide models for actinide compounds that may exist in either vitrified nuclear waste or in repositories located within salt deposits that have significant borate content. In addition, the radiation-damage resilience of polyborate networks positions these materials as suitable candidates for probing coordination chemistry and physical properties much deeper into the actinide series than is normally possible, and compounds with actinides up to californium (Z = 98) have been successfully prepared and characterized in exquisite detail. Structural determination of these materials show that both the lanthanide and actinide series display previously unknown coordination chemistry, but, more importantly, that the two series have little overlap in terms of structure and composition, and have few parallels. In addition, some of these compounds display unique physico-chemical properties, one example of which is the selective trapping of radionuclides. The foremost discovery first identified in actinide borates is that the chemistry of californium represents an onset of unprecedented chemical behavior that compares better with high-oxidation state, early transition metal complexes than it does with earlier *f*-elements.