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Characterizing Rare Earth Elements at Aqueous Interfaces

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Rare earth elements are utilized in a diverse range of modern and evolving technologies. Current methods for separating and purifying these elements involve their interactions at liquid interfaces. For example, the primary separations technique in current use, known as solvent extraction, involves molecular binding and assisted transport across liquid-liquid interfaces. Other techniques in development utilize rare earth element adsorption to liquid-vapor and liquid-solid interfaces. The development of these techniques has taken place largely in the absence of an understanding of interfacial distributions of rare earth elements, and of the binding, coordination, and ordering of rare-earth elements with molecular species at the interface. This provides an opportunity for the use of X-ray surface scattering and spectroscopy to investigate these issues. Hopefully, these investigations will inform the development of more efficient and cleaner separations processes of rare earth elements. In addition, the +3 charge on most rare earth ions and their complex coordination with many molecules provides an opportunity to understand new interfacial science. I will review X-ray studies in this area, mostly from my research group's activities, with an emphasis on the information that can be learned from X-ray techniques that characterize rare earth elements at aqueous interfaces.

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