

European Network on NMR Relaxometry

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Rare Earth Elements Ions Dynamics in Ionic Liquid Media

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Rare Earth Elements (REE) e.g. Lanthanides + Yttrium and Scandium are essential in high technology products for renewable energy like magnets for wind turbine, NiMH batteries or compact fluorescent lamps (CFL). However, the increasing demand and the limited availability have lead to market instabilities. The recycling of these products becomes then an alternative to limit mining production and supply dependence. Nowadays, industrial reprocessing of REE is mainly performed by liquid/liquid extraction using large amounts of acid, toxic organic solvents and other ligands.

In the 2000's, the use of IL for nuclear fuel reprocessing opened the way to a new route for liquid/liquid extraction. In these processes, the organic phase can be replaced by an ionic liquid (IL) that is a liquid salt with a melting point below 100°C containing an organic cation and an organic or inorganic anion. Interestingly, it has been shown that the use of IL can remarkably enhance the extraction rate of REE ions from acidic solution as compared to usual organic solvents¹.

However, the selectivity and the capacity of ILs to extract the wanted ion, depending on temperature, nature of REE ion and IL structure is not so far well understood. Several ion-pairing or ion-exchange mechanisms have been proposed but extraction remains a grey area. NMR relaxometry is a powerful tool to understand the solvation of these ions and their interaction with anionic and cationic parts of the ionic liquid solvent. We propose here to study the dynamics of REE ions in ionic liquid media in order to improve the selectivity and efficiency of extraction via ionic liquid route. Preliminary results obtained with Fast Field Cycling NMR relaxometry will be presented.

(1) Ionic Liquids: New Hopes for Efficient Lanthanide/Actinide Extraction and Separation? **Isabelle Billard**, *Handbook on the Physics and Chemistry of Rare Earths* 213-273, (2013)