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Interaction of Metals with Non-Conventional Solvents

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Abstract : Ionic liquids and deep eutectic mixtures represent so-called non-conventional solvents. The former, composed of discrete ions, is a salt with a melting temperature below 100°C. The latter, consisting of hydrogen bond donors and acceptors, is a mixture of at least two compounds, resulting in a melting temperature depression in comparison with that of the individual moiety. These systems also can be water-immiscible, which makes them applicable for metal extraction. This work will cover interactions of In, Tl, Ir, and Rh in hydrochloric acid media with eutectic mixtures and Er, Ir, and At in a gas phase with chemically modified α-detectors. The purpose is to study chemical systems based on non-conventional solvents in terms of their interaction with metals. Once promising systems are found, the next step is to modify the surface of α-detectors used in the online element production at cyclotrons to get the detector chemical selectivity. Initially, the metal interactions are studied by means of the liquid-liquid extraction technique. Then appropriate molecules are chemisorbed on the surrogate surface first to understand the coating quality. Finally, a detector is covered with the same molecule, and the metal sorption on such detectors is studied in the online regime. It was found that chemical treatment of the surface can result in 99% coverage with a monolayer formation. This surface is chemically active and can adsorb metals from hydrochloric acid solutions. Similarly, a detector surface was modified and tested during cyclotron-based experiments. Thus, a procedure of detectors functionalization has been developed, and this opens an interesting opportunity of studying chemisorption of elements which do not have stable isotopes.

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