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Functionalised Titania and Zirconia Materials for Selective Actinide and Lanthanide Separations

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Actinides and lanthanides are targets for partitioning from solutions of spent nuclear fuel. Traditionally, actinide separation processes are based on liquid-liquid extraction. However, use of solid phase sorbent materials has several advantages such as the lack of organic solvent wastes. Framework materials based on titania and zirconia have been developed and functionalised with organic ligands in order to impart selectivity. Titania and zirconia based framework materials were chosen due to their radiolytic and hydrolytic stability, as well as the fact they can be easily converted to transmutation matrices or wasteforms once they are loaded with actinides. The framework materials used vary in complexity from simple nanoparticles to millimetre sized, spherical, hierarchically porous beads. In terms of organic ligands, functionalisation with phosphonates, amines and bistriazinyipyridine (BTP) has been performed to impart selectivity for lanthanides, uranium or minor actinides.

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