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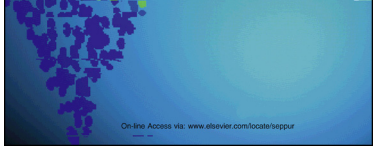

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Separation of cerium(III) from lanthanum(III), neodymium(III) and praseodymium(III) by oxidation and liquid-liquid extraction using ionic liquids

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ABSTRACT

A process for the separation of cerium from a lanthanide powder using ionic liquids is reported. In a first step, starting from a mixture of cerium(III) sulphate, neodymium(III) sulphate, lanthanum(III) chloride and praseodymium(III) chloride, cerium(III) was successfully oxidised into cerium(IV) under alkaline conditions, whereas all other lanthanide ions remained in their third oxidation state. The lanthanide hydroxide salts formed in this step were then dissolved in a nitric acid solution. Efficient and selective extraction of Ce(IV) towards trihexyltetradecylphosphonium bis(trifluoromethanesulfonyl)imide $[P_{66614}][NTf_2]$ or 1-methyl-1-butylpyrrolidinium bis(trifluoromethanesulfonyl)imide $[C_1C_4Pyrr][NTf_2]$ was then achieved. The pyrrolidinium cation was found to be more efficient using $[C_1C_4Pyrr][NTf_2]$ than $[P_{66614}][NTf_2]$. Cerium was then recovered by a stripping step using a weakly concentrated nitric acid solution, yielding a complete regeneration of the ionic liquid. Finally, recycling of $[C_1C_4Pyrr][NTf_2]$ was studied carrying out ten cycles consisting in an extraction step followed by a stripping step using the same ionic liquid phase. Extraction of Ce(IV) was found to remain high, starting from 97 % extraction and slightly decreasing down to 88 % at the end of the cycling process.

KEYWORDS

Cerium oxidation.
Liquid-liquid extraction.
Lanthanide separation.
Ionic liquid.
Inductively coupled plasma.