



## **Solvent Extraction of Thorium: from the Recovery to High Purity Products**

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Thorium is an important radioactive element associated with rare earth elements in the resource such as bastnaesite and monazite. It is also a potential nuclear fuel due to the conversion of  $^{232}\text{Th}$  to  $^{233}\text{U}$  under slow neutron bouncing. So, to eliminate the radioactive pollution and provide the feed for the novel nuclear reactors, the recovery and purification of thorium is an important topic of rare earth metallurgy. From the 1970's, our lab has been working on the separation and purification of thorium from the rare earths ores using primary amine as the extractant. Recently, we developed a series of nitrogen-containing extractants to recover thorium from rare earth concentrate and screened out an efficient one Cextrant 230 which has applied for invention patents PCT/CN2015/077208 and PCT/CN2015/077212. The novel extractant exhibits excellent extraction performance toward thorium in sulphate medium at lower acidity. Under the same conditions, trivalent rare earth elements are hardly been extracted. The separation of cerium(IV) and thorium can be realized by adjusting the aqueous acidity. A bench-scale test to deal with sulfuric acid leaching of bastnaesite was processed, by which thorium was efficiently recovered. To further purify the obtained thorium product, another extractant labeled N501 was screened. A solvent extraction process with centrifugal extractors was proposed to prepare ultrapure thorium, which has been patented as China patent ZL201110074345.8 and ZL201210552752.X, US patent 9,347,116 B2 and Australia patent 2013201027. Dozens of kilograms of ultrapure thorium products was obtained.