




Abstract

Extraction of Nd(III) by Hydrophobic Deep Eutectic Solvent BTMPPA/Phenol from Nitrate Solution [†]

Inna V. Zinov'eva ^{*}, Yulia A. Zakhodyaeva  and Andrey A. Voshkin 

Kurnakov Institute of General and Inorganic Chemistry, Russian Academy of Sciences, Moscow 119071, Russia; yz@igic.ras.ru (Y.A.Z.); aav@igic.ras.ru (A.A.V.)

^{*} Correspondence: iz@igic.ras.ru

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Abstract: Today, rare earth elements (REEs) are used in the production of high-tech products, including permanent magnet lasers, computer equipment, etc. The recycling of NdFeB magnets is a promising REE resource, as the amount of waste-spent magnets increases with increasing demand. Solvent extraction is an effective method in the hydrometallurgical processing of Nd-FeB magnets. Recently, researchers have been using alternative solvents in the development of new REE extraction processes. Hydrophobic deep eutectic solvents are increasingly proposed as promising extractants for a wide range of organic and inorganic substances. The aim of the present work is to study the extraction of Nd(III) with a hydrophobic deep eutectic solvent based on di(2,4,4-trimethylpentyl)phosphinic acid (BTMPPA) and phenol. The HDES was prepared from a hydrogen bond acceptor (BTMPPA) and donor (phenol) in a molar ratio of 1:3. All extraction experiments were carried out at a temperature of 25 °C and an atmospheric pressure of ~100 kPa in graduated centrifuge tubes with a thermostatically controlled shaker. The present study aims to determine the distribution coefficients of Nd(III) in the extraction system using HDES BTMPPA/phenol. It was found that the distribution coefficient of Nd(III) is 0.43 with a ratio of aqueous phase and HES phase equal to 1:1. Changing the volume ratio of the phases will allow the metal to be concentrated in the HDES phase. In addition, the influence of the acidity of the aqueous phase was found in the pH range from 0 to 7. The results showed the possibility of increasing the distribution coefficient of Nd(III) up to 0.97 with increasing pH. Thus, the promising use of HDES BTMPPA/phenol in the extraction of neodymium from nitrate solution was shown. The obtained data can be used in the development of new effective hydrometallurgical processes of REE extraction from a leaching solution of spent magnetic materials.

Keywords: hydrophobic eutectic solvent; phosphinic acid derivative; phenol; extraction system; neodymium



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