

2 - 33 Grafted Polypropylene by Electron Beam Irradiation

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An grafted adsorbent was synthesized by post irradiation grafting of acrylonitrile (AN) on to a polypropylene (PP) non-woven using 1.5 MeV electron beam accelerator. The grafted poly(acrylonitrile) chains can be chemically modified to convert a nitrile group to an amidoxime (AMO) group, a chelating group responsible for uranium uptake from an aqueous solution. The grafting extent was estimated gravimetrically using the relation;

$$\text{Grafting degree}(\%) = \frac{\text{Weight after grafting} - \text{initial weight}}{\text{initial weight}} \times 100\%$$

The grafting progress show in Fig. 1.

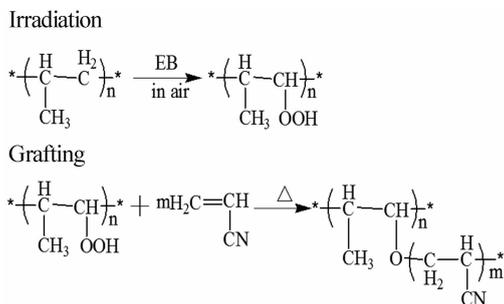


Fig. 1 Grafting progress.

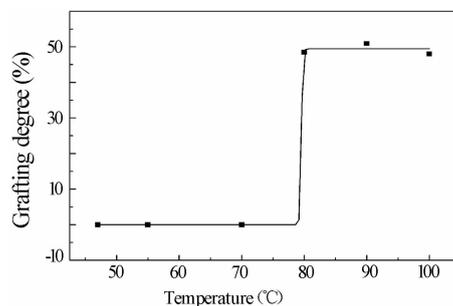


Fig. 2 Effect of temperature on grafting rate.

As the grafting reaction as well as the decomposition of peroxide are chemical reactions, change in temperatures may affect the final grafting levels. In order to probe the effect of temperature on grafting, the grafting reaction is carried out at different temperatures. The result showed in Fig. 2 indicates that the grafting reaction take place when temperature exceed 65 °C, and higher temperature will not improve the grafting rate.

References

- [1] Virendra Kumar, Y. K. Bhardwaj, Separation Science and Technology, 41(2006)3123.
- [2] S. M. Badawy, H. H. Sokker, S. H. Othman, Radiation Physics and Chemistry, 73(2005)125.

2 - 34 Solvent Extraction of Am(III) and Eu(III) with a Picolinamide Ligand

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Partitioning and transmutation (P&T) is the one of the most important strategy to reduce the long-term radiotoxicity of HLW. The basic idea is to separate the minor actinide elements (MA = Np, Am, and Cm) from the waste and convert them by neutron fission (transmutation) into shorter-lived or stable elements. And the separation of MA from lanthanides is one of the essential subjects to establish transmutation technology.

For separating trivalent actinides [An(III)] and lanthanides [Ln(III)] in HLW, we studied the solvent extraction of Am(III) and Eu(III) with picolinamide ligands. A picolinamide ligand, N,N'-(ethane-1, 2-diyl)dipicolinamide, was synthesized and its structure was determined by ¹H-NMR, E-MS and X-ray diffraction(Fig. 1). The effect of acidity (Fig. 2) proved that the distribution ratio of Am(III) increases along with pH, especially in HCl. Slope analysis and the equimolar series method (Fig. 3) proved 2 : 1

complexes are formed for Am(III) and Eu(III), such as $\text{Am}_2(\text{NO}_3)_6\text{L}$ and $\text{Eu}_2(\text{NO}_3)_6\text{L}$.

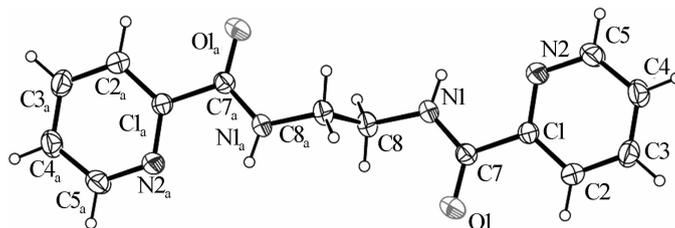


Fig. 1 X-ray diffraction of N,N'-(ethane-1,2-diyl)dipicolinamide.

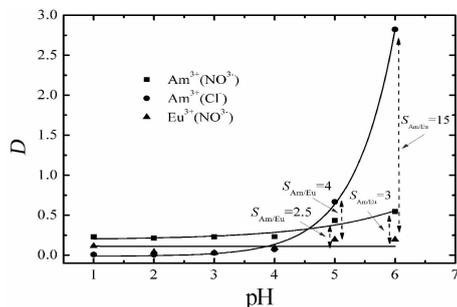


Fig. 2 The effect of acidity.

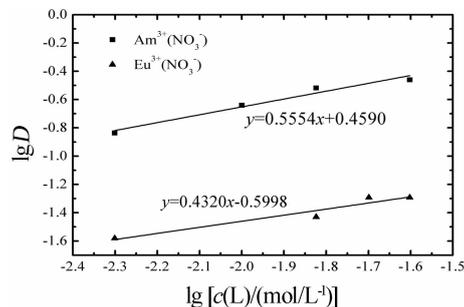


Fig. 3 Slope analysis.

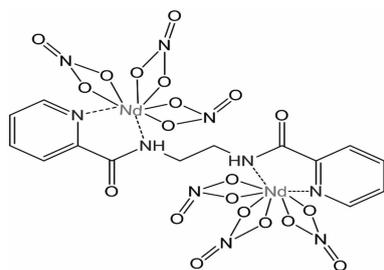


Fig. 4 The possible structure of extracted complex.

Besides, the radius of Nd(III) (0.983 Å) is approximate with that of Am(III) (0.980 Å). The FT-IR spectra (Fig. 4 and Table 1) showed that the N atoms of N-H and pyridine in the picolinamide ligand form coordinate compound with Nd(III), which doesn't like other picolinamide ligands formed by O of C=O. So we concluded that the N atoms prefer to coordinate with trivalent actinides [An(III)] and lanthanides [Ln(III)] than O provided by picolinamide ligands. The structure of extraction complex may be shown as Fig. 4.

In summary, the ligand has application potential to the separation process of An(III) from Ln(III), and further investigations to develop better derivatives using the technique are expected.

Table 1 The analysis of FT-IR spectra

Samples	$\sigma(\text{O-H})$	$\sigma(\text{N-H})$	$\sigma(\text{C=O})$	$\sigma(\text{pyridine})$
Pure picolinamide	—	3332.2	1659.3	1588.7, 1570.5, 1532.2, 1465.7, 1434.1
After extracting HNO_3	3432.9	3332.1	1658.5	1588.6, 1569.7, 1531.7, 1465.1, 1434.9
After extracting Nd(III) from HNO_3	3435.8	3331.7	1658.5	1588.5, 1570.5, 1531.6, 1465.4, 1433.7

References

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