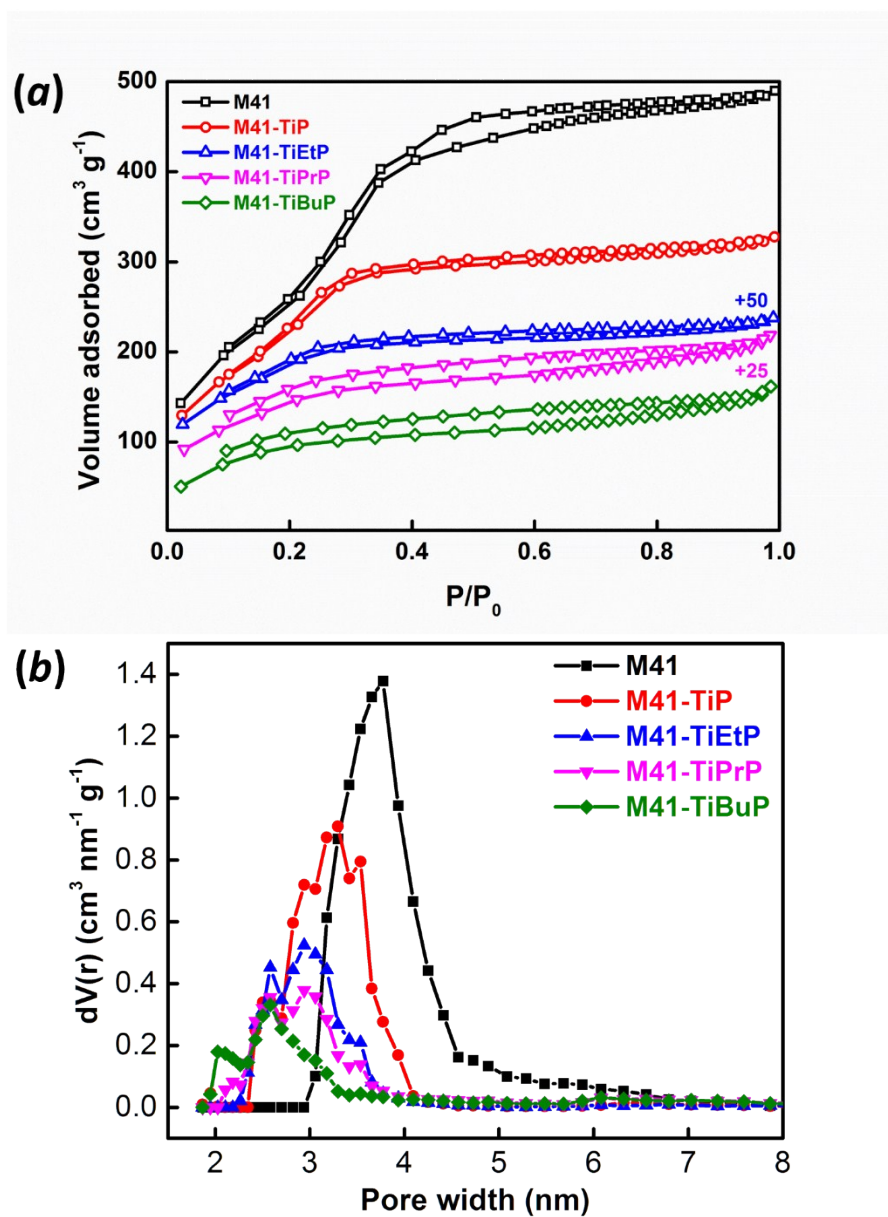


## **Titanium alkylphosphate functionalised mesoporous silica for enhanced uptake of rare-earth ions**

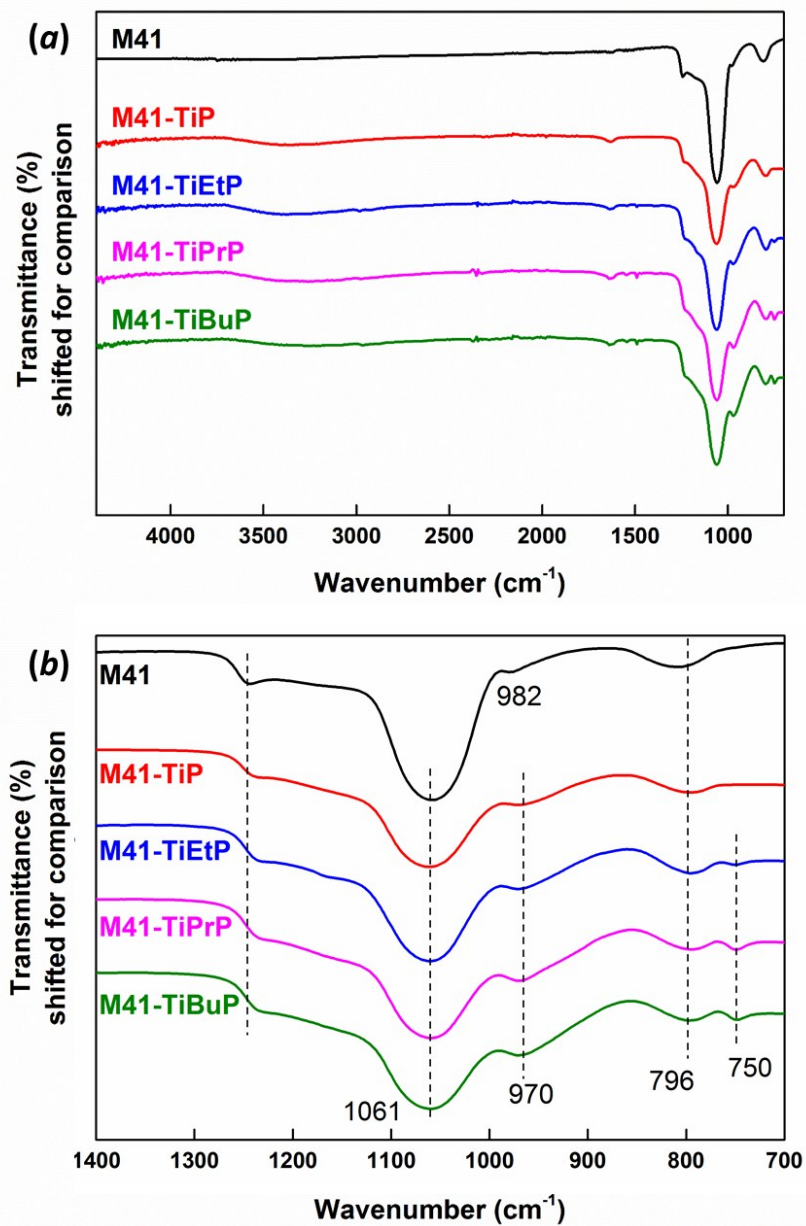
**Wenzhong Zhang,<sup>a,\*</sup> ‡ Dženita Avdibegović,<sup>b,‡</sup> Risto Koivula,<sup>a</sup> Timo Hatanpää,<sup>c</sup> Sami Hietala,<sup>c</sup> Mercedes Regadío,<sup>b</sup> Koen Binnemans<sup>b,\*</sup> and Risto Harjula<sup>a</sup>**

- a. Department of Chemistry – Radiochemistry, P.O. Box 55, FI-00014 University of Helsinki, Finland.
- b. Department of Chemistry, KU Leuven, Celestijnenlaan 200F, B-3001 Heverlee, Belgium.
- c. Department of Chemistry, P.O. Box 55, FI-00014 University of Helsinki, Finland

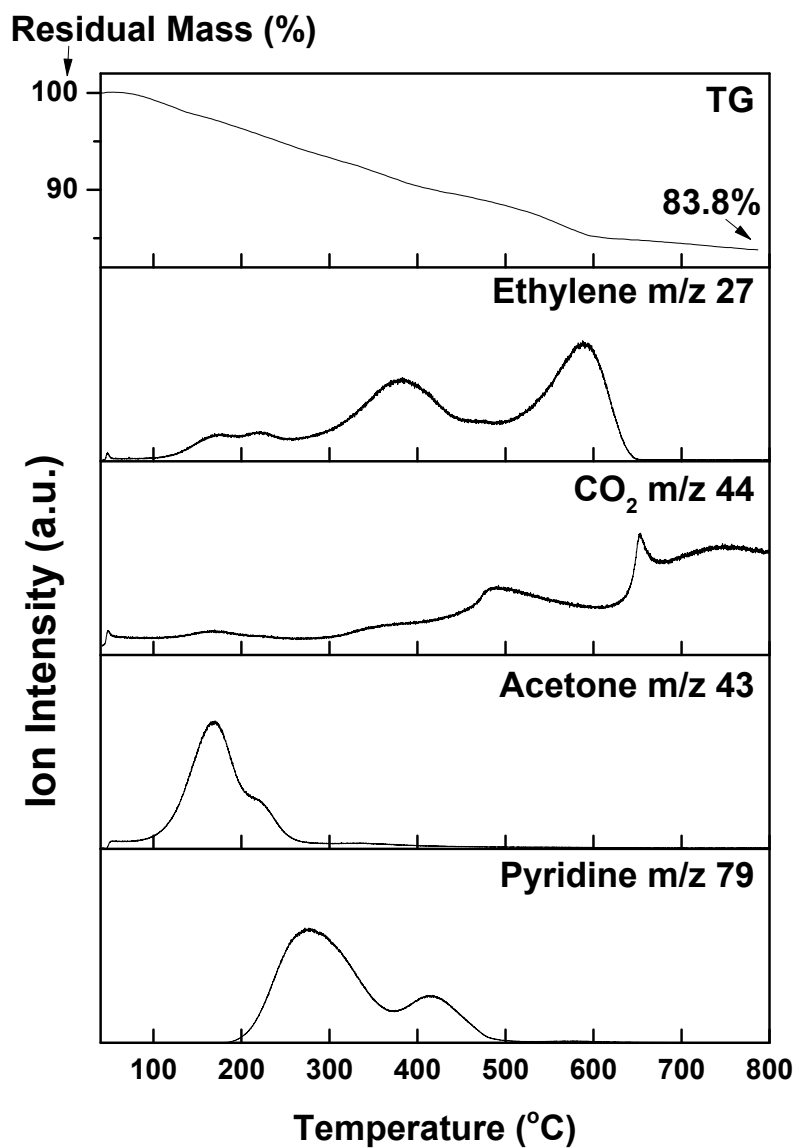
**Electronic Supplementary Information (ESI)**



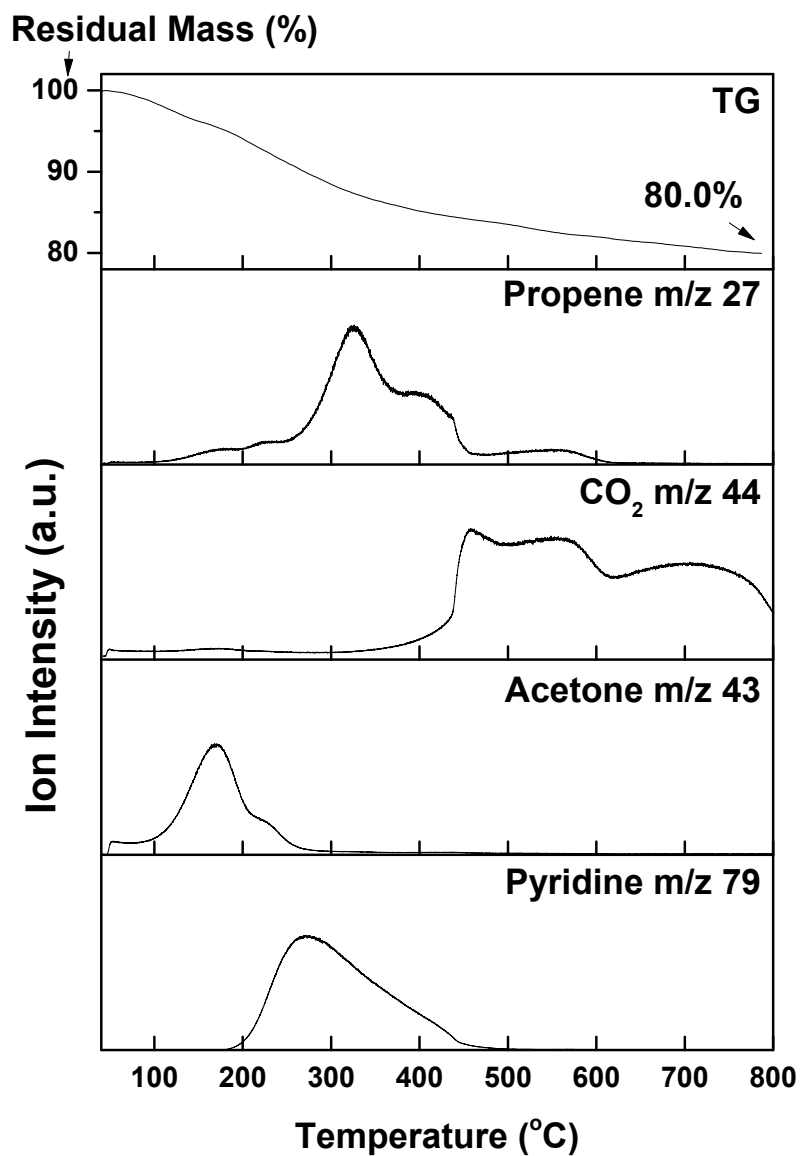
**Figure S1.** Nitrogen adsorption-desorption isotherms (a) and respective NLDFT pore-size distribution curves (b) of the synthesised materials.



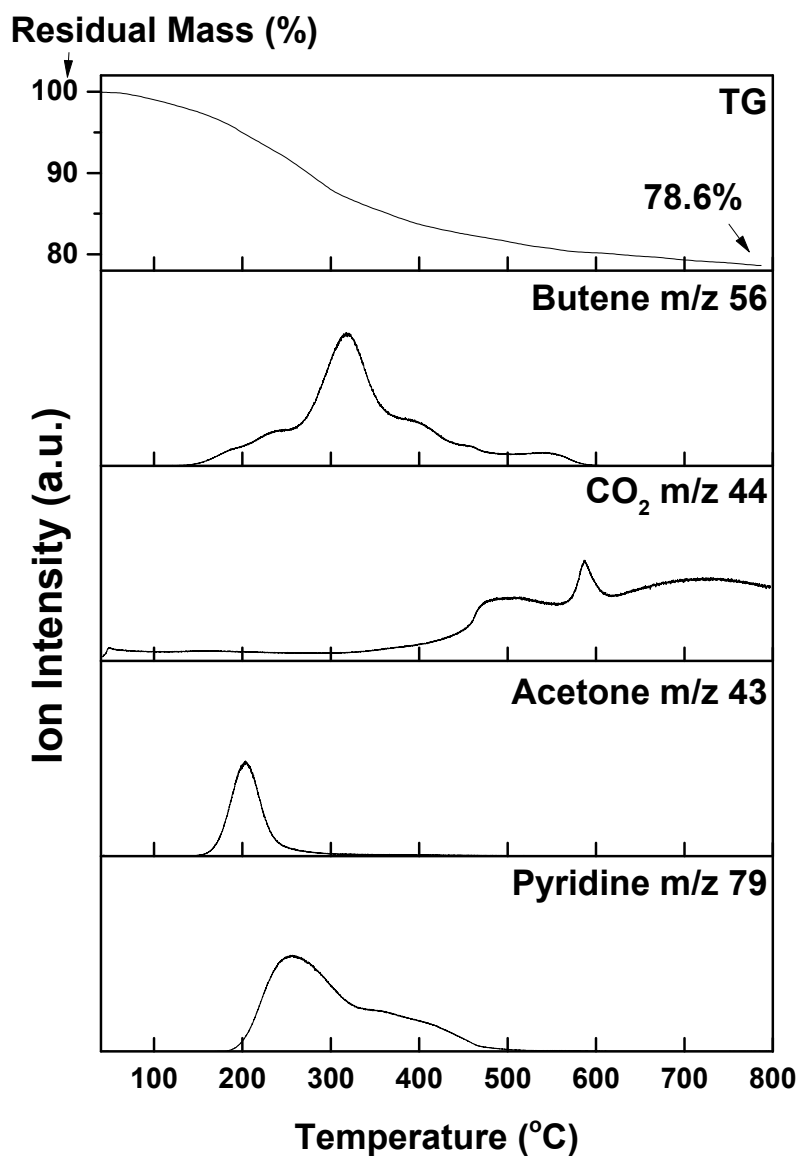
**Figure S2.** ATR-FTIR spectra of the synthesised materials (a) with an enlarged view on the wavenumber region from 700 to 1400  $\text{cm}^{-1}$  (b).



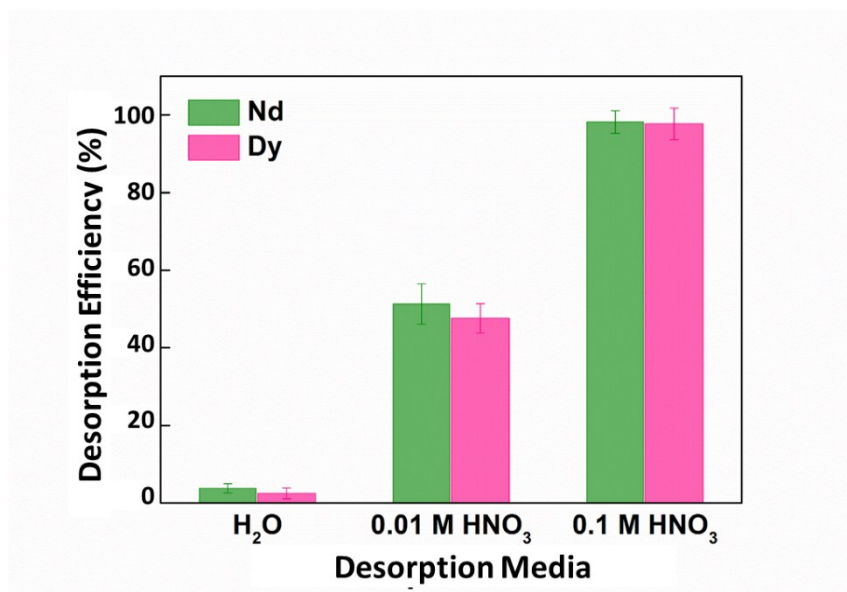
**Figure S3.** TG/DSC–MS results of the M41-TiEtP material. The top graph shows the thermogravimetical curve while the remaining four graphs indicate the corresponding evolved gas captured by MS detector.



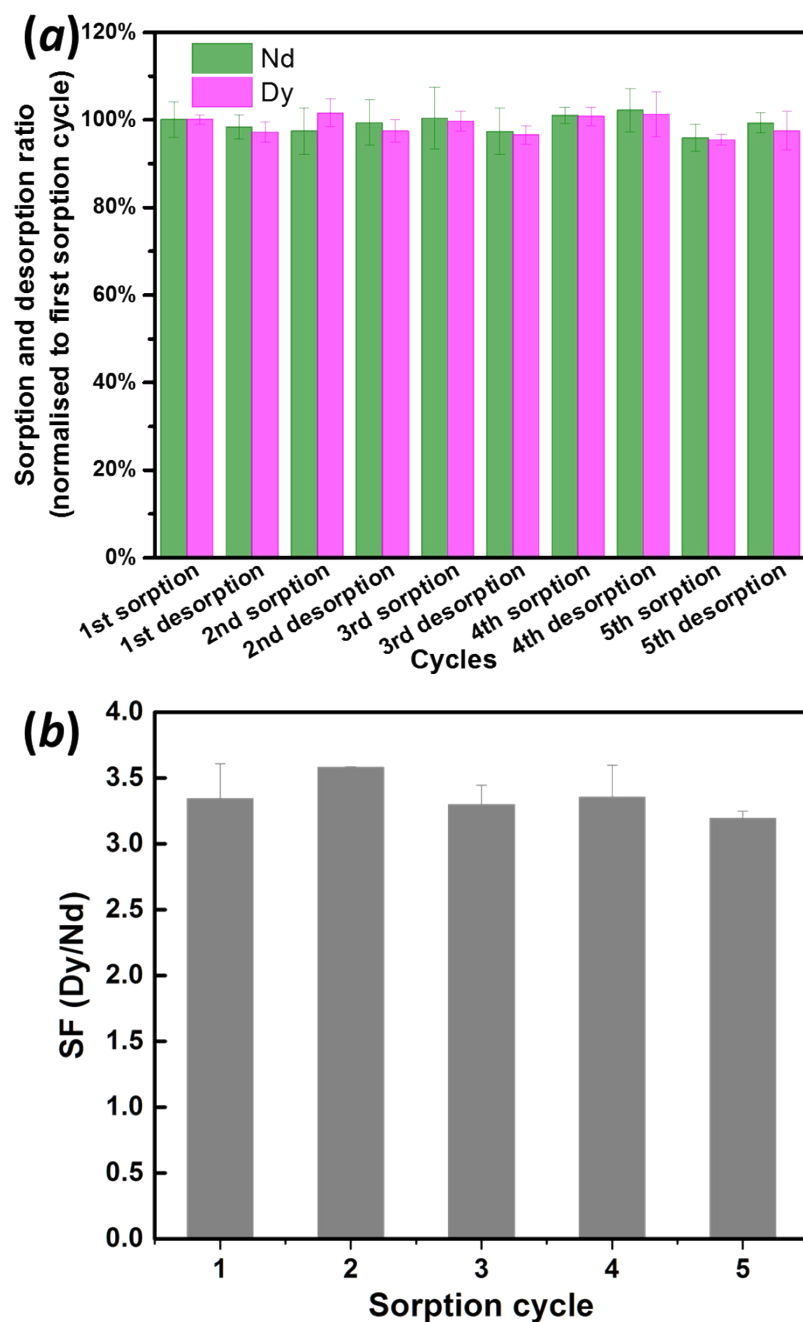
**Figure S4.** TG/DSC–MS results of the M41-TiPrP material. The top graph shows the thermogravimetric curve, while the remaining four graphs indicate the corresponding evolved gas captured by MS detector.



**Figure S5.** TG/DSC–MS results of the M41-TiBuP material. The top graph shows the thermogravimetical curve while the remaining four graphs indicate the corresponding evolved gas captured by MS detector.



**Figure S6.** Desorption efficiencies using water, 0.01 M and 0.1 M nitric acid on M41-TiPrP material. Initial sorption solution composition: 1 mM Nd, 1 mM Dy and 5 M NH<sub>4</sub>NO<sub>3</sub>, sorption solid-to-liquid ratio: 50 mg/ 20 mL and equilibrium pH ca. 2. Desorption solid-to-liquid ratio: 50 mg/ 20 mL.



**Figure S7.** Cyclic sorption-desorption tests on M41-TiPrP material: (a) sorption and desorption ratios of Nd and Dy normalised to the first sorption cycle uptake, and (b) SF(Dy/Nd) values for each sorption cycle. Initial sorption solution composition: 1 mM Nd, 1 mM Dy and 5 M  $\text{NH}_4\text{NO}_3$ , sorption solid-to-liquid ratio: 50 mg/ 20 mL and equilibrium pH ca. 2. Desorption solution: 0.1 M  $\text{HNO}_3$  and desorption solid-to-liquid ratio: 50 mg/ 20 mL.