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## Thorium incorporation in phosphates matrices: the case of xenotime

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The management and the conditioning of radwaste represents a major challenge in the nuclear industry. Therefore a variety of host matrices have been studied, including several phosphate based ceramics.<sup>1</sup> They represent promising candidates for the specific conditioning of actinides (III, IV) owing to their easy way of preparation and high chemical durability.<sup>2</sup>

The incorporation of actinides in such phases has been extensively studied through solid-state routes. Thus, it often requires repetitive grinding steps and re-heating to avoid the formation of heterogeneous compounds.<sup>3</sup> For such reasons, the synthesis of target compounds in aqueous solution were developed to prepare pure and homogenous phases.

In this study, a particular attention was paid to the incorporation of tetravalent actinides ( $\text{Th}^{4+}$ ,  $\text{U}^{4+}$ ) in the zircon structure type through the coupled mixed ( $\text{An(IV)} + \text{SiO}_4 / \text{Ln(III)} + \text{PO}_4$ ) substitution.

In this frame, solid solutions of  $\text{Er-xThx(PO}_4\text{)}_{1-x}\text{(SiO}_4\text{)}_x$  were obtained in application of the method developed to prepare pure coffinite ( $\text{USiO}_4$ ), i.e. hydrothermal conditions at  $250^\circ\text{C}$  for 7 days.<sup>4</sup> The analysis of the PXRD data showed the formation of single phases. The structure crystallizes in the zircon-type structure (I41/amd group, tetragonal system) as observed for the end-members  $\text{ThSiO}_4$  and  $\text{ErPO}_4$ . From Rietveld refinements, the formation of a complete solid solution was confirmed in agreement with the Vegard's law. A thorough analysis was also carried out by Raman spectroscopy and EXAFS at the Er and Th edges and showed an exciting structural evolution.<sup>5</sup>

### References

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### Summary

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