Solubility of the rhabdophane ($LnPO_4.0.667H_2O$): A low temperature precursor of the monazite

CLÉMENCE GAUSSE[1*], ADEL MESBAH[1], STÉPHANIE SZENKNECT[1], NICOLAS CLAVIER[1], STEFAN NEUMEIER[2], DIRK BOSBACH[2] AND NICOLAS DACHEUX[1]

[1]ICSM UMR 5257 CEA/CNRS/UM2/ENSCM Site de Marcoule, BP 17171, F-30207 Bagnols-sur-Cèze cedex, France (*clemence.gausse@cea.fr)

[2]Forschungszentrum Jülich GmbH, 52425 Jülich, Germany

Minerals belonging to the monazite family, $REEPO_4$ (REE: Y, Sc, La-Dy) could incorporate in their structure substantial amounts of Th and U [1]. Moreover, monazites maintain their crystallinity even after geological times of exposure to self-irradiation. Therefore, this phase appears to be a promising candidate as a specific matrix for the conditioning of transuranic elements (An^{IV},An^{III}). Already, many thermodynamic properties of monazite are reported in the litterature [2]. However, it's hydrated form namely, Rhabdophane, $REEPO_4.0.667H_2O$ could be stabilized at low temperatures, and thus control the concentrations of actinides in solution after the leaching of the monazite matrices [3] [4]. For the first time, a thorough study was conducted in order to determine $K_{s,0}°$, $\Delta_f G°$ and $\Delta_f H°$ of the $LnPO_4.0.667H_2O$ end-members (Ln = La-Dy). Both over-saturated and under-saturated solubility experiments in acidic conditions were achieved at several temperatures.

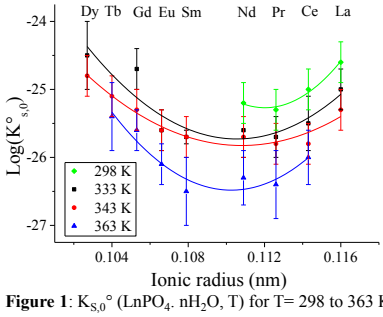

Figure 1: $K_{S,0}°$ ($LnPO_4.nH_2O$, T) for T= 298 to 363 K.

The obtained results indicate that the stability domain of the rhabdophane phase is limited in temperature and depend on the ionic radius of the lanthanide. The values of the solubility constant depend also slightly of the lanthanide, and present a minimum in the middle of the series (Figure 1).

[1] Clavier *et al*. (2011) *J. Eur. Ceram. Soc*. **31**, 941-976. [2] Poitrasson et al. (2004) *Geochim. Cosmochim. Acta* **68,** 2207-2221. [3] Du Fou de Kerdaniel *et al*. (2007) *J. Nucl. Mater*. **362**, 451-458. [4] Dacheux *et al*.(2013) *Am. Min*. **98**, 833-847.