Standard Enthalpies of Formation of Monazite and Xenotime

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REE partitioning and miscibility gap ranges in the $CePO_4$-YPO_4 system are of interest for geothen-nobarometry, since monazite and xenotime are widespread accessories in granitoids and metamorphic rocks and often used for geological dating. However, very few experiments were done previously to estimate thermodynamic properties of these compounds. As part of research on thermodynamics of lanthanide orthophosphates, enthalpies of formation of monazite and xenotime were obtained by high temperature oxide melt solution calorimetry. The samples used were $CePO_4$ and YPO_4 monocrystals grown at 1360°C by means of the flux technique. Refined cell parameters were consistent with JCPDS standards. Enthalpies of drop solution have been measured using sodium molybdate ($3Na_2O$-$4MoO_3$) and lead borate ($2PbO$-B_20_3) melts. Bubbling with oxygen has been used to speed up the dissolution process and, in the case of cerium, to control its oxidation in the solvents. Applying the appropriate thermochemical cycles, standard enthalpies of formation of $CePO_4$ and YPO_4 were calculated to be - 1 961±2 and - 1993±2 kJ per mol, respectively. The values for several other REE orthophosphates will be also presented.

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