

Hydrothermal Synthesis, Heat Capacity Functions and Enthalpy of Formation for Sodium Titanium Hydroxyphosphate, $\text{Na}_4\text{Ti}(\text{OH})_2(\text{PO}_4)_2$

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Sodium titanium hydroxyphosphate “STHP”, $\text{Na}_4\text{Ti}(\text{OH})_2(\text{PO}_4)_2$, is an important reaction product of aqueous sodium phosphate in contact with titanium alloys at high temperatures and pressure. Hydrothermal synthesis of STHP was carried out starting with titanium oxide (rutile) and aqueous sodium phosphate at 250 °C and the samples were characterized by ICP, Raman, XRD and FTIR. The heat capacities of STHP as a function of temperature and pressure have been measured up to 350 °C. The solid phase undergoes reversible phase transition at 282 °C and its Maer-Kelly heat capacity functions have been derived. Enthalpy of solution measurements were measured for STHP in aqueous HClO_4 containing Na_3NTA . The enthalpy of solution data for STHP was combined with enthalpy of solution measurements for TiCl_4 (l) in aqueous solution of perchloric acid, to derive the first experimental value for the enthalpy of formation of STHP. The results are in excellent agreement with the thermodynamic data for STHP derived from solubility measurements.