

Experimental Measurement of the Thermal Conductivity of the NZP Compound Family

V.I. Pet'kov and V.N. Loshkarev

Department of Chemistry, Nizhni Novgorod State University, Nizhni Novgorod Region, Russia

E.A. Asabina^{C,S}

All-Russian Research Institute of Experimental Physics, Russian Federal Nuclear Center, Nizhni Novgorod Region, Russia
asea@uic.nnov.ru

The NZP ($\text{NaZr}_2(\text{PO}_4)_3$) family of materials attract a wide interest because of their stability in extreme conditions and flexibility towards ionic substitutions. Some phosphates with such a structure are characterized by ultralow thermal conductivity.

We made measurements of the thermal conductivity in the range from 298 to 673 K using a heat flow meter apparatus with a claimed uncertainty of 8 %. The thermal conductivity of NZP-compounds: $\text{NaM}_2(\text{PO}_4)_3$ ($\text{M} = \text{Ti}, \text{Zr}, \text{Hf}$), $\text{Na}_5\text{M}(\text{PO}_4)_3$, $\text{CsZr}_2(\text{PO}_4)_3$, $\text{Sr}_{0.5}\text{Zr}_2(\text{PO}_4)_3$, and $\text{Zr}_3(\text{PO}_4)_4$ was studied in air on ceramic samples with porosities of 12 to 32 %. The approximated heat conductivity values of the near-zero porosity samples at the above temperature interval are 0.6 to 1.5 $\text{Wt}/(\text{m}\cdot\text{K})$. Some relations were obtained in order to correlate the thermal behavior of the materials with their content and physical characteristics. It is important that, on the whole, NZP ceramics have lower heat conductivity than individual stabilized zirconia, which is the main ceramic-forming component of widely applied thermal-resistant materials.