

Synthesis, Structure and Properties of NZP/NASICON Structured Materials

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Abstract : The purpose of this work was to synthesize and investigate phase formation, structure and thermophysical properties of the phosphates $M_{0.5+x}M\#39;Zr_2\text{--}x(\text{PO}_4)_3$ ($M = \text{Cd, Sr, Pb; } M\#39; = \text{Mg, Co, Mn}$). The compounds were synthesized by sol-gel method. The results showed formation of limited solid solutions of NZP/NASICON type. The crystal structures of triple phosphates of the compositions $\text{MMg}_{0.5}\text{Zr}_{1.5}(\text{PO}_4)_3$ were refined by the Rietveld method using XRD data. Heat capacity (8–660 K) of the phosphates $\text{Pb}_{0.5+x}\text{Mg}_x\text{Zr}_2\text{--}x(\text{PO}_4)_3$ ($x = 0, 0.5$) was measured, and reversible polymorphic transitions were found at temperatures, close to the room temperature. The results of Rietveld structure refinement showed the polymorphism caused by disordering of lead cations in the cavities of NZP/NASICON structure. Thermal expansion (298–1073 K) of the phosphates $\text{MMg}_{0.5}\text{Zr}_{1.5}(\text{PO}_4)_3$ was studied by XRD method, and the compounds were found to belong to middle and low-expanding materials. Thermal diffusivity (298–573 K) of the ceramic samples of phosphates slightly decreased with temperature increasing. As was demonstrated, the studied phosphates are characterized by the better thermophysical characteristics than widespread fire-resistant materials, such as zirconia and etc.

Keywords : NASICON, NZP, phosphate, structure, synthesis, thermophysical properties

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