

# Crystal structures and properties of new compounds in MgO-In<sub>2</sub>O<sub>3</sub>-P<sub>2</sub>O<sub>5</sub> ternary systems

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Due to the characteristics of structural diversity, high chemical and thermal stability, phosphate has been extensively investigated for their potential application in functional materials, such as lithium-ion battery electrode and fluorescent lighting phosphor. In our work, subsolidus phase relations of MgO-In<sub>2</sub>O<sub>3</sub>-P<sub>2</sub>O<sub>5</sub> ternary system has been systematically investigated. Samples were successfully synthesized by the conventional solid-state reaction method and analyzed by means of X-ray powder diffraction.

The MgO-In<sub>2</sub>O<sub>3</sub>-P<sub>2</sub>O<sub>5</sub> ternary system is composed of eleven three-phase regions. Two new compounds MgIn<sub>1.5</sub>P<sub>3</sub>O<sub>12</sub> and MgInP<sub>2</sub>O<sub>4</sub> were observed in this system. The crystal structure of MgIn<sub>1.5</sub>P<sub>3</sub>O<sub>12</sub> and MgInP<sub>2</sub>O<sub>4</sub> was solved based on powder X-ray diffraction data by the charge flipping method [1] using Jana2006 program [2], and refined by the Rietveld method [3] using Fullprof\_suite program [4]. MgIn<sub>1.5</sub>P<sub>3</sub>O<sub>12</sub> crystallizes in triclinic system and MgInP<sub>2</sub>O<sub>4</sub> in monoclinic system. In compound MgInP<sub>2</sub>O<sub>4</sub>, the 3-dimensional framework can be considered as a set of parallel 2-dimensional [P<sub>2</sub>O<sub>7</sub>]<sub>n</sub> layers perpendicular to the *c* axis composed of two PO<sub>4</sub> tetrahedra sharing corners, which indicates that the compound may possess unique properties in the field of functional material.

Luminescence property of MgIn<sub>1.5</sub>P<sub>3</sub>O<sub>12</sub> and MgInP<sub>2</sub>O<sub>4</sub> phosphors doped rare earth have been investigated. By doping Eu<sup>3+</sup>, the spectroscopic properties such as optical absorption and photoluminescence spectra and decay time measurements for the <sup>5</sup>D<sub>0</sub> level of Eu<sup>3+</sup> ions were obtained. A strong red fluorescence is observed from the <sup>5</sup>D<sub>0</sub> level of Eu<sup>3+</sup> ions in these phosphors. As for the Tb<sup>3+</sup>-doped phosphors, bright green emissions at about 489nm can be observed under the excitement of ultraviolet radiation.

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