

Watnatee Pullarp 2014: Photoluminescent Study of Dy(III) and Mn(II) Doped MgAl₂O₄ Ceramics Prepared via One-pot Process. Master of Science (Chemistry), Major Field: Chemistry, Department of Chemistry. Thesis Advisor: Associate Professor Sudjit Sanguanruang, Ph.D. 68 pages.

A simple and less energy consuming method for preparing MgAl₂O₄ spinel and ion-doped MgAl₂O₄ ceramics was developed, adopting the process of oxide one-pot synthesis (OOPS) and stepwise calcination at low temperatures. The starting materials, *i.e.* Al₂O₃, MgO, and triethanolamine were mixed at mole ratio of 1:1:3, using ethylene glycol as solvent. As for the doped ceramics, the dopant Dy(III) as Dy(CH₃COO)₃ or/and Mn(II) as Mn(CH₃COO)₂ was added in various mol% as desired. Four different types were prepared, *i.e.* undoped MgAl₂O₄, Dy(III)-doped, Mn(II)-doped, and Dy(III),Mn(II)-codoped MgAl₂O₄ ceramics. Brown polymer-like precursors were attained after heating the starting mixtures at 190 °C for 6 h. The precursors were then calcined in steps: 500 °C for 5 h, 750 °C for 5 h, and 850 °C for 2 h. The solid ceramics obtained were ground to powders. The XRD patterns indicated that the produced ceramics were not of pure spinel, but a solid solution of γ -Al₂O₃ and MgAl₂O₄. The compositions of the synthesized ceramics as determined by EDX, nonetheless, showed satisfactory doping yield of 99.26 ± 25.91 % at 95 %CL. The SEM images revealed the microstructure of the ceramics were mostly blocky particles in irregular shapes with hexagonal crystalline form appeared occasionally. A fiber-like structure also occurred in the codoped ceramics. Being excited at λ_{ex} 350.8 nm, the Dy(III)-doped ceramics emitted yellow fluorescence at λ_{em} 574.5 nm which was identified with the ⁴F_{9/2}→⁶H_{13/2} transition of Dy(III). The Mn(II)-doped MgAl₂O₄, excited at λ_{ex} 302 nm, gave reddish-orange fluorescence at λ_{em} 658 nm corresponding to the ⁴T₁→⁶A₁ transition of Mn(II). It was found that the presence of Dy(III) in Dy(III),Mn(II)-codoped ceramics had intensified the 658-nm fluorescence of Mn(II) through a Dy(III)→Mn(II) energy transfer process.

Student's signature

Thesis Advisor's signature