YAG/Al_2O_3複合セラミックス発光材料の合成と発光特性

Preparation and Luminescent Properties of YAG/Al_2O_3 Composites Phosphors Ceramics

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Laser-driven solid state lighting is a newly emerged technology that enables to produce high-power and super-brightness white light by combining a blue laser diode (LD) with a yellow luminescent material. The color converter, as one of the key components in laser lighting, must be thermally robust and luminescence efficient as it experiences high flux-density irradiation and thermal attack caused by the high power incident laser. In this work, we design a Al_2O_3-YAG:Ce phosphor ceramic with an unique composite structure, where yellow-emitting YAG:Ce particles are embedded in a thermally conductive Al_2O_3 matrix (Fig. 1). The composite phosphor ceramics exhibit a high external quantum efficiency of 76% (upon 460 nm excitation), a superior in-line transmittance of 55% at 800 nm, and a high thermal conductivity of 18.5 $Wm^{-1}K^{-1}$. When irradiated under a 444 nm blue laser, the phosphor ceramic with a thickness of 0.1 mm shows a linear relationship between the luminous flux and the input current under a high power density of 50 Wmm^{-2}, validating its suitability for high-brightness solid state laser lighting.

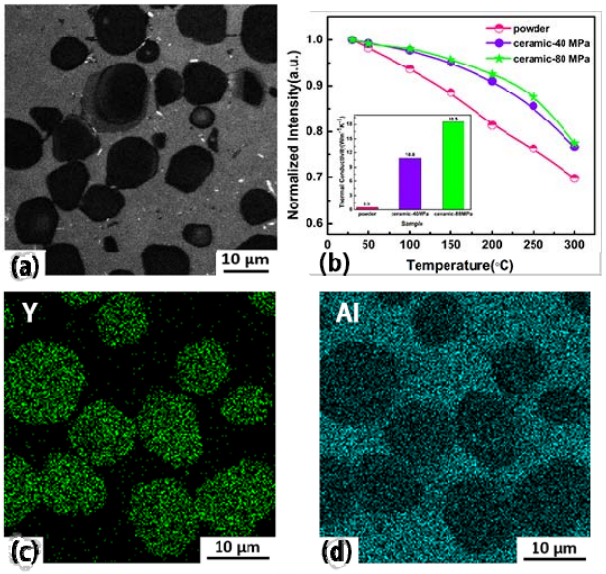

Figure 1 (a) SEM image of the YAG/Al_2O_3 composite phosphor ceramics, with large YAG phosphor particles (black) embedded in the Al_2O_3 matrx (grey), (b) thermal quenching and thermal conductivity of YAG/Al_2O_3 ceramics, (c) distribution of Y element and (d) distribution of Al element.