Fabrication of Highly Transparent γ-AlON Ceramics from High Sinterability Powders by Using Spark Plasma Sintering Method and Hot Isostatic Pressing Post-treatment

National Institute for Materials Science [1], Xiamen University[2], Lihong Liu,[1] Chenning Zhang,[1] Kohsei Takahashi,[1] Toshiyuki Nishimura,[1] Hiroyo Segawa,[1] Naoto Hirosaki,[1] Rong-Jun Xie[2]

E-mail: Liu.Lihong@nims.go.jp

Highly-transparent γ-AlON ceramics were fabricated with using γ-AlON powders synthesized from Al_2O_3 and AlN, and prepared $MgAl_2O_4$ as raw materials by spark plasma sintering (SPS) technique at 1800 ^oC for 5 min under 80 MPa pressure assisted with post-treatment of hot isostatic pressing (HIP) at 1800 ^oC for 2 h under 190 MPa pressure. The sintered transparent ceramic fabricated by the prepared γ-AlON powders with using $MgAl_2O_4$ as additive demonstrated almost even grains and no pores either at the grain boundaries or inside the grains, with a high in-line transmittance efficiency in the region of UV~visible wavelength, as high as ~80.5% at 450 nm wavelength (Figure 1), which is attributed to a contribution of the $MgAl_2O_4$ additive in efficiently promoting the sinterability of γ-AlON powders and finally resulting in the high densification of γ-AlON transparent ceramic.

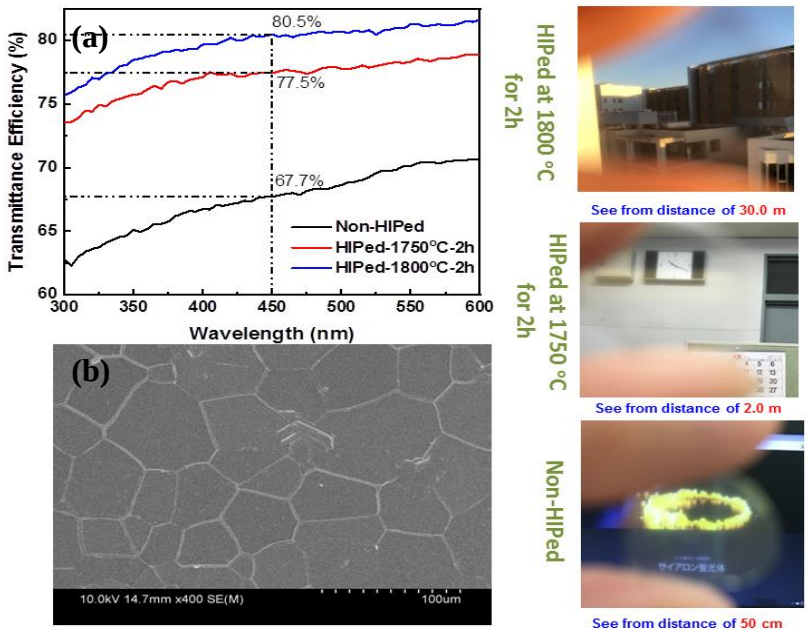

Figure 1. In line transmittance efficiencies of γ-AlON ceramics prepared from the γ-AlON powders synthesized by using $MgAl_2O_4$ as Mg^{2+} source with and without HIP treatment(a), surface microstructures of γ-AlON transparent ceramic after HIP treatment at 1800 ^oC for 2 h under 190 MPa (b), and photographs viewing from various distances through the γ-AlON transparent ceramic fabricated by using $MgAl_2O_4$