

Spatial distribution of the Yb³⁺ rare earth ions in Y₃Al₅O₁₂ and Y₂O₃ optical ceramics as analyzed by TEM.

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There is a need to investigate the possible improvements of rare earth ion-doped transparent ceramics in terms of better optical performances for lasers, scintillators and phosphors. Especially, the spatial distribution of the rare earth ions within their host material is important for quenching processes. Results from Transmission Electron Microscopy (TEM, both conventional and high resolution TEM) and EDX (energy dispersive X-ray) quantitative chemical analysis positively show that there is no significant segregation of Yb³⁺ ions, the last active rare earth element, in the grain boundaries of Yb³⁺-doped YAG and Yb³⁺-doped Y₂O₃ polycrystalline ceramics. The large value of the Yb³⁺ segregation coefficient (1.09 in YAG ceramic) explains the homogeneity of this distribution, in opposition to the low values of the Ce³⁺ and Nd³⁺ segregation coefficients, the first active rare earth elements, (0.08 and 0.18 respectively in YAG ceramic), which leads to a strong segregation at grain boundaries.

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