Photoluminescence, radioluminescence and optically stimulated luminescence in nanoparticle and bulk $KMgF_3(Eu)$

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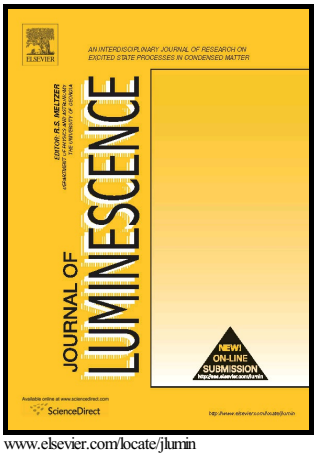

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Photoluminescence, radioluminescence and optically stimulated luminescence in nanoparticle and bulk $KMgF_3$(Eu)

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Abstract

Photoluminescence (PL) and radioluminescence (RL) were observed in both bulk polycrystalline and nanoparticle $KMgF_3$(Eu). Eu^{2+} and Eu^{3+} emissions were detected in the PL of both samples. The nanoparticles had more Eu^{3+}, more distorted Eu^{3+} sites, and a higher PL quantum efficiency when compared to the bulk compound. X-ray-induced valence conversion of Eu^{2+} to Eu^{3+} was observed in the bulk, while Eu^{3+} to Eu^{2+} was found for nanoparticles. The valence conversion was reversed for the bulk compound by UV bleaching (254 nm) and partially reversed in the nanoparticles by 330 nm stimulation. F_2 and F_3-centre PL was observed in the bulk after X-ray irradiation but was absent in the nanoparticles. PL from other point defects occurred in both samples that is likely to be oxygen related. The PL from one of these defects in the nanoparticles changed with X-ray irradiation or UV illumination and the PL slowly recovered at room temperature. We propose this may be due to charge-transfer in O^{2-}-F^{+} pairs where this defect could potentially be used in a solar UV dosimeter. Optically stimulated luminescence was observed only from Eu^{2+} in the bulk material that can be used