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Persistent luminescence excitation of BaAl2O4:Eu2+,Dy3+

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BaAl2O4:Eu2+,Dy3+ is the heaviest but the least efficient persistent luminescent material in the MAl2O4:Eu2+,R3+ series. Low efficiency may be due to the hygroscopic host material and/or polymorphic crystal structure [1]. Both may deteriorate the persistent excitation and emission through a change in the trap structure thus shortening the persistent duration. Charging of BaAl2O4:Eu2+,Dy3+ is rather slow, a steady state was achieved only after 30 s. Deconvolution of the thermoluminescence (TL) curves yielded a single trap with a depth of 0.8 eV after UV irradiation. Results agree well with studies on BaAl2O4:Eu2+,Dy3+ prepared with solid state and combustion methods [2]. 3D persistent excitation spectroscopy used in this study gives more detailed information than the simple TL measurements. The irradiation of BaAl2O4:Eu2+,Dy3+ with 200 to 500 nm UV-vis radiation has no effect on the shape of the TL glow curves consisting of a single band at 57 ℃. The excitation spectra show little fine structure: at least two bands at 280 and 330 nm (max) with a shoulder at 380 nm. This structure may be due to the splitting of the 2D excited level of Eu2+. The use of free solar energy for excitation is thus limited. The 3D TL emission spectra show only one broad band at 500 nm despite two Ba2+ sites. The BaAl2O4:Eu2+,Dy3+ materials are interesting persistent phosphors though UV excitation is required. The shallow trap at 0.8 eV yields weak and short persistent luminescence at room temperature, as well. A stable crystal structure would be an advantage, too.
References
[1] J. Hölsä, H.C. Swart, L.C.V. Rodrigues, H.F. Brito, M. Lahtinen, M. Lastusaari, ESTAC-11, Aug. 17-21, 2014, Espoo, Finland.
[2] L.C.V. Rodrigues, R. Stefani, H.F. Brito, M.C.F.C. Felinto, J. Hölsä, M. Lastusaari, T. Laamanen, M. Malkamäki, J. Solid State Chem. 183 (2010) 2365.

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