Optically stimulated detrapping in persistent phosphors

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Persistent phosphors, also called glow-in-the-dark materials, are a specific type of luminescent materials which can emit light long after the excitation ended. This is realized by temporarily storing energy in the crystal lattice. Ambient heat or pressure can release the trapped charge carriers, after which recombination and light emission can occur.

For many applications, such as in emergency signage, the storage capacity of persistent phosphors should further be increased. This would open new application areas, such as glowing road marks [1]. We show that the excitation of the europium center in the blue emitting $Sr_2MgSi_2O_7$:Eu,Dy by near-UV light not only leads to charge trapping, but also to optically stimulated release of previously trapped charges and subsequent luminescence (OSL) [2]. This is substantiated by specific charging-OSL experiments making use of the presence of a thermal barrier for trapping at low temperature. Furthermore, the optical detrapping is observed to be significantly more important when a larger fraction of the traps is already filled, suggesting OSL is the limiting factor in the storage capacity of persistent phosphors.

[1] J. Botterman and P. F. Smet, "Persistent phosphor $SrAl_2O_4$:Eu,Dy in outdoor conditions: saved by the trap distribution," Opt. Express **23**, A868-A881 (2015)
[2] C. Tydtgat et al., "Optically stimulated detrapping during charging of persistent phosphors," Opt. Mater. Express **6**, 844-858 (2016).