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Afterglow suppression and non-radiative charge-transfer in CsI:Tl,Sm[1] L.A. KAPPERS, R.H. BARTRAM, D.S. HAMILTON, Physics Department, University of Connecticut, Storrs, CT, A. LEMPICKI, C. BRECHER, ALEM Associates, Boston, MA, V. GAYSINSKIY, E.E. OVECHKINA, V.V. NAGARKAR, RMD Inc., Watertown, MA — The feasibility of substantially diminishing afterglow in CsI:Tl scintillator material by co-doping with Sm^{2+} is demonstrated. Rate equations informed by experiment predict that deep samarium electron traps scavenge electrons from shallow thallium traps. In addition, combined radioluminescence and thermoluminescence experiments on a sample of CsI:Tl,Sm with nominal concentrations of 0.11% Tl^{2+} and 0.2% Sm^{2+} suggest that electrons released by samarium recombine non-radiatively with holes trapped as $V_{KA}(Tl^{+})$ centers, thus providing a mechanism for suppression of trapped-charge accumulation in repetitive applications. A linear-coupling model in the harmonic approximation, based on quantum chemistry calculations with selective lattice relaxation, supports the conclusion that non-radiative charge-transfer is enabled by low-energy excited states of Sm^{2+}.

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