

Abstract Submitted
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Enhanced fluorescence in rare earth doped sol-gel glasses containing Al³⁺ GREGORY ARMSTRONG, ANN SILVERSMITH, Hamilton College, DANIEL BOYE, Davidson College — Sol-gel synthesis is a low temperature method for preparing rare earth (RE) doped glass. Aluminum is often used as a co-dopant because it increases fluorescence yield from RE's. There is a tendency for RE ions to form clusters in the sol-gel preparation, facilitating inter-ion interactions and fluorescence quenching from cross relaxation. It is generally believed that Al prevents clustering of RE ions, but recent work questions this long-established role of Al. We report on spectroscopic investigations of energy transfer in Tb- and Eu-doped glasses that probe the effect of Al co-doping. Pulsed laser excitation of ⁵D₃ fluorescence is used to measure Tb-Tb cross-relaxation rates. In materials containing Al, cross-relaxation occurs in concentrations much lower than 0.1%Tb, indicating that RE clustering persists in glasses with Al. Line narrowing experiments in dilute Eu glasses confirm that ions remain clustered in co-doped samples. Our results point toward a model of aluminum rich regions in the glass that attract and confine RE ions. Reduced association with OH⁻ in the confined regions causes RE fluorescence enhancement.

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