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Processes related to phototransfer under blue- and green-light illumination in annealed Al_2O_3:C,Mg

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ABSTRACT

Phototransferred thermoluminescence (PTTL) of Al_2O_3:C,Mg induced by 470 nm blue, 525 nm green, and 870 nm infrared light is reported. Although its conventional TL glow curve measured during heating to 600 °C has seven peaks (labeled I–VII), only peak II is reproduced under phototransfer, except when the sample is preheated to 180 °C when peak IV also re-appears. The dependence of PTTL intensity on the duration of illumination for both PTTL peaks is analyzed using phenomenological and kinetic models as systems of acceptor and donors, with the number of the latter determined by experiment. The intensity of PTTL increases with the temperature of illumination with an activation energy of thermal assistance of either 0.015 ± 0.002 or 0.047 ± 0.002 eV when either 470 or 525 nm light is used but decreases at elevated temperatures with an activation energy of thermal quenching equal to 0.51 ± 0.02 eV independent of illumination wavelength. The long term behavior of time-response profiles for a system of one acceptor and a single donor, as an exemplar, as studied by stability theory, shows an unstable critical point. Mechanisms for the PTTL are discussed and the emission is ascribed to electron centers in the oxygen sub-lattice.

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