Purposes: To explain the causes of fading in the Al2O3:C optically stimulated luminescence detectors (OSLDs).
Methods: A phenomenological band diagram model with three electron traps and two recombination centers was used to represent the entities that are related to the OSL of Al2O3:C OSLDs. The electron traps consist of a shallow trap, the main dosimetric trap and a deep trap. The shallow trap is unstable at room temperature (activation energy of 1.03 eV). Both recombination centers are radiative, however, the OSL signal is due only to one of the recombination centers. This model was based on experimental data of the thermoluminescence, optical absorption and OSL of Al2O3:C. A system of differential equations representing the transport and storage of charge carriers during irradiation, relaxation and stimulation phases was solved numerically. The system of equations was solved at room temperature conditions (T = 295 K).
Results: The simulated shape of the OSL decay curve was in good qualitative agreement with experimental data. The simulated dose response of the OSL signal was linear in the interval of doses investigated (up to 10 Gy). The simulated fading of the OSL signal occurred in the first 10 min elapsed since irradiation and then became stable.
Conclusions: The fading behavior of the OSL signal of Al2O3:C OSLDs can be explained by the existence of a shallow trap that is unstable at room temperature.