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Thermostimulated luminescence of $Y_2W_3O_{12}$ ceramics

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Thermostimulated luminescence (TSL) of $Y_2W_3O_{12}$ and $Y_2W_3O_{12}$:Eu ceramics has been studied. Activation energy values and frequency factors corresponding to individual capture centers have been determined. The TSL bands of $Y_2W_3O_{12}$ based ceramics are stated to be due mainly to monoenergetic capture centers. The TSL bands with maxima at 111, 122, 180 and 205 K are associated with recombination processes in YO_6 octahedrons while those at 158, 238 and 262 K, with WO_4 tetrahedrons.

Исследована термостимулированная люминесценция (ТСЛ) керамик $Y_2W_3O_{12}$ и $Y_2W_3O_{12}$:Eu. Определены энергии активации и частотные факторы, соответствующие выделенным центрам захвата. Установлено, что выделенные полосы ТСЛ в керамиках на основе $Y_2W_3O_{12}$ в основном обусловлены моноэнергетическими центрами захвата. Полосы ТСЛ с максимумами при 111, 122, 180 и 205 К связываются с рекомбинационными процессами в октаэдрах YO_6, а полосы с максимумами при 158, 238 и 262 К — в тетраэдрах WO_4.

The oxide type compounds are among crystalline substances of most importance from the standpoint of their application to produce efficient luminophors. Tungstates, including $Y_2W_3O_{12}$, take a substantial place among such compounds [1]. In particular, $Y_2W_3O_{12}$:Eu is believed to be a commercial red luminophor of promise [2]. The spectral characteristics of those materials were studied in several works [1–3], but there are some scientific problems in this field which remain still unclear. In this work, the charge carrier capture centers (CC) in $Y_2W_3O_{12}$ and $Y_2W_3O_{12}$:Eu ceramics are studied and their parameter are determined using thermoactivation methods. The study of those properties seems to be actual enough, since the traps define to a great extent some parameters of the luminophor, in particular, the decay time constant.

The studies have been performed using ceramic samples produced by isothermal sintering of previously mixed, grated and compressed mixtures of Y_2O_3:$3WO_3$ stoichiometric composition. The annealing temperature exceeding 1000°C provided the $Y_2W_3O_{12}$ formation reaction in a mixture of Y_2O_3 and WO_3 [4]. This fact was confirmed by X-ray diffraction examinations. Yttrium oxide of YtO-I grade or Y_2O_3:Eu luminophor and tungsten oxide of OSCh (special purity) grade were used as initial materials.

To study the thermostimulated luminescence (TSL), the samples were places in a vacuum cryostat where the temperature was varied within 80–400 K range. The samples were X-ray irradiated using an URS-55A unit (40 kV, 10 mA) with a copper anticathode at 80 K. The X-ray dose was measured by a IDMD-1 dosimeter. The exposure dose was varied from 0.15 to 2.35 C/kg. The TSL emission intensity was recorded using a FEU-51 PMT with electrometric amplifier U1-7 generating the signal transmitted to a PDA-1 recorder. The heating linearity was provided by a RIF-101 temperature controller. The heating rate was $\beta = 0.150 \pm 0.065$ K/s providing a sufficient