

## Interaction between trapping centers in corundum anion-defective single crystals

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The study results concerning involvement of chromium ions in the interaction between traps in corundum anion-defective single crystals are presented. In the main peak of thermo stimulated luminescence at 450 K in the luminescence band of  $\text{Cr}^{3+}$  ions has been found to have the same anomalous features as in the predominating luminescence band of F-centers. This effect has been supposed to be caused by a resonance mechanism of energy transfer from excited F-centers to chromium ions. It has been found that in anion-defective single crystals of corundum, a trap connected with chromium ion interacts with deep trapping centers. The results obtained supplement the interactive trap system model taking into account thermal ionization of excited states of F-centers. The presence of the thermal ionization process was confirmed by new experimental data.

Представлены результаты исследования участия ионов хрома в процессах интерактивного взаимодействия ловушек в монокристаллах анион-дефектного корунда. Обнаружено, что термостимулированная люминесценция в основном пике при 450 K в полосе свечения ионов  $\text{Cr}^{3+}$  характеризуется теми же аномальными особенностями, что и в доминирующей полосе свечения F-центров. Высказано предположение, что возможной причиной этого эффекта является резонансный механизм передачи энергии от возбужденных F-центров к ионам хрома. Обнаружено, что в анион-дефектных монокристаллах корунда существует интерактивное взаимодействие между ловушкой, связанной с ионами хрома, и более глубокими центрами захвата. Полученные результаты дополняют модель интерактивной системы ловушек, учитывающую процесс термической ионизации возбужденных состояний F-центров, существование которого подтверждено новыми экспериментальными данными.

The main (dosimetric) peak of thermo stimulated luminescence (TL) in aluminum oxide anion-defective single crystals is observed at 450 K [1]. To date, the origin of this peak remains unclear. Some researchers think that the peak is due to a complex defect including oxygen vacancies in different charge states and impurity chromium ions. The main peak TL has some anomalous features: the light sum drops as the heating rate increases and the mean TL activation energy decreases in the course of the fractional glow technique (FGT) application [2]. A model taking into account the interaction of main traps with deep trapping centers identified at 730 and 880 K, was proposed [3, 4] to explain the mechanism of the main peak TL. Usually, these crystals exhibit one

more TL peak at 573 K (heating rate 2 K/s) which is associated with the presence of chromium ions. An active role of chromium ions in recombination processes in the crystals at hand is confirmed also by the fact that emission bands of these ions are present in the spectrum of the TL peaks at 450 and 573 K. However, the part played by chromium ions in the interaction between traps in anion-defective corundum has not been studied up to now.

This work deals with interactive processes involving impurity chromium ions in anion-defective corundum single crystals grown under reducing conditions. It concerns also a further development of model concepts describing TL mechanisms in these crystals.