DIAMOND THERMOLUMINESCENCE PROPERTIES OF DIFFERENT CHONDRITES

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It have been found that TL glows of diamonds depend on a)the origin of diamonds and b) the chondrite metamorphism degree.

We have continued the investigation of thermoluminescence (TL) of diamonds [1] and here consider the results for diamonds from Murchison CM2, Krymka LL3.0, Kainsaz CO3 and Abee E4. For comparison have been analyzed also the diamonds synthesized by CVD-process (samples # 133, 159) and by detonation way from soot (DDS-B14-89). Before the TL measuring samples were annealed at ~350°C during a few second and then irradiated by γ-rays of Cs-137 up to doze ~ 200 krad. TL-measurements were performed in the air atmosphere on the standart equipment [2]. TL data for samples are shown on Figure. Here is also presented TL glow for some diamonds from [1]. The reseach of TL glow curves has shown following :

1) TL glow of Earth's and synthetic diamonds depend on their genesis. In equilibrated synthesis of diamonds { e.g.,DN 3/2 } in TL glow curves there is only one clear high-temperature peak and in extremely unequilibrated synthesis {e.g., UDD } there is only low-temperature peak. In intermediated conditions synthesis of diamonds (film diamonds } in TL glow curves there are both high-and low-temperature peaks. The locations of peak maximum for all diamonds with the exception of DDS-B14-89 sample are observed in 175-190°C and 290-310°C. In the case of low intensity of peaks the position their maximum is displaced in more high-temperature range due to the influence of high-temperature TL glow. The correlation of TL glow peak intensities for film diamonds is not constant and probably this fact reflects the conditions of their synthesis.

TL glow curve for DDS-B14-89 also have only one peak, but with T(max) ~230°C. Unfortunately the crystals structure of this sample is insufficiently studied. According to some data in this sample is perhaps lonsdaleite, but this question is being settled

2) Presolar diamonds at least the diamonds of Efremovka and Kainsaz chondrites by TL glow are similar to UDD sample in the most degree. Therefore we suggest the presolar diamonds could be mainly formed as well as UDD in extremely unequilibrated process from carbon and/or carbonaceous compounds in gaseous phase. Perhaps this process has been proceeded in atmosphere of supernova by influence of shock waves [3].

The diamonds of Abee chondrite could be formed in the Solar system [4]. It is interesting TL glow for the Abee diamonds agrees with those for the DDS-B14-89 diamonds which contain probably lonsdaleite. The diamond crystals from Abee and DDS-B14-89 are sharply differented by sizes: for first the crystal sizes exceed 0.1 μm [4], while for second they are essentially smaller (~ 0,005 μm, Tatsy, pers.comm.). Nevertheless TL glows for these diamonds indicates on identical structure peculiarities of their crystals.

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3) The intensity of TL glow for presolar diamonds in low-temperature range ($\leq 250^{\circ}C$) and respectively the intensity of peak are increased relatively high - temperature TL glow for chondrites in follow sequence: Murchison, Krymka, Kainsaz, and Efremovka. The unequilibrium degree of these chondrite matters is also decreased in the same way. Perhaps the alteration of TL glow of diamonds is the result of the metamorphism process. We assume diamond crystals with most defective structure condition the persistent TL glow in large temperature intervals and that just these diamond crystals would be are lightly destroied during metamorphism processes.

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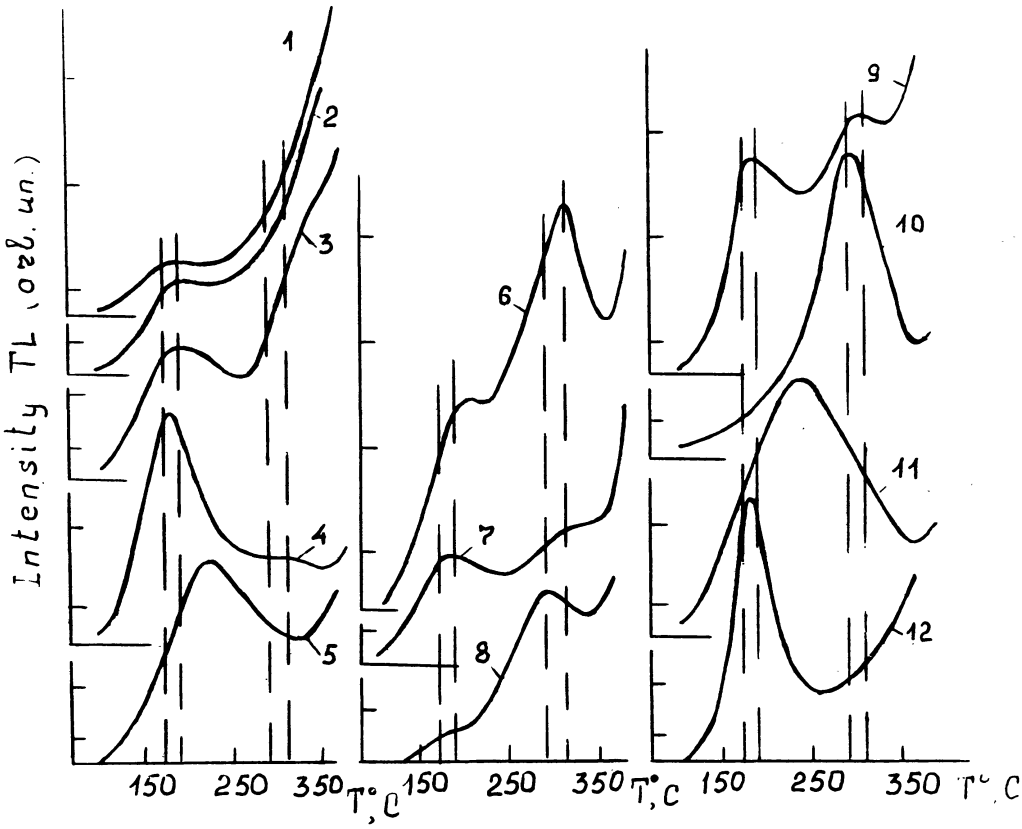

Figure. TL glow curves. 1,2,3,4,and 5 - the diamonds of Murchison, Krymka, Kainsaz, Efremovka, and Abee chondrites, respectively; 6,7,8,and 9 -the film diamonds (6,7 - sample # 133, 8 - sample # 159, 9 - sample # 21H); 10 - the diamonds (DN 3/2) from kimberlite pipe; 11 - the DDS-B14-89 diamonds;12 - ultradispersioned diamonds (UDD). 9,10, and 12 TL glow curves are taken from [1]. The dotted lines determine the intervals 175-190°C and 290-310°C.

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