

**Thermoluminescence measurements in shocked oligoclase.** *A.I.Ivliev, D.D.Badjukov, and L.L.Kashkarov.* Vernadsky Institute of Geochemistry and Analytical Chemistry, Russian Academy of Sciences, Moscow, Russia

Results of measurements of thermoluminescence (TL) in experimentally shocked oligoclase and quartz samples have been reported earlier [1,2]. We present here a further study of induced TL in the oligoclase samples shocked in a range of 9 - 27 GPa. The measurements of induced TL were carried out after irradiation of a  $\gamma$ -ray Cs-137 source up to dose of 20 krad. There were five sequential irradiations and measurements of TL in each sample. The intensity of induced TL (TL sensitivity) and the temperature of heating at which this occurs were measured (Fig. 1). The obtained TL curves were processed for deconvolution of the spectrum with Gauss peaks [3]. These calculations allow to represent a curve as a set of the peaks with a constant peak full width at half maximum (FWHM) for given glow curves.

Most convenient results were obtained when the TL curves were presented as eleven peaks having constant FWHM. The results of the calculation of a TL curve for a oligoclase sample shocked at 22.5 GPa are shown on Fig. 2 as an example. A lower curve on Fig. 2 demonstrates a relative deviation of the summary curve of the Gauss peaks from the experimental TL curve. The maximal deviation of calculated area under summary curves of all Gauss peaks from the experimental ones is not higher than 1.5 % in the all measurements. All processed experimental TL curves have approximately equal values of FWHM and temperatures these Gauss peaks. The calculated data show a good correspondence between FWHM and temperature. The average values of FWHM and temperatures for third, fourth, eighth, and ninth Gauss peaks are in Table 1. The TL sensitivities of these peaks and others increase by every new step of an irradiation and a TL measurement. However forms of the TL curves are identical at any measurements in spite of alteration of the TL sensitivities. An average summary TL sensitivity of third and fourth peaks ( $S_{LT}$ ), the same of eight and ninth peaks ( $S_{HT}$ ), and  $S_{HT}/S_{LT}$  ratios are in Table 2. All values are expressed relatively to a summary sensitivity of third and fourth peaks in the unshocked sample. Errors of  $S_{HT}/S_{LT}$  ( $1\sigma$ ) are calculated from values of  $S_{HT}/S_{LT}$  in each set of five measurements.

It can be noted that the TL sensitivity of oligoclase samples shocked at 13.0 and 27.0 GPa is even higher than the TL sensitivity of an unshocked sample. However a ratio of the TL sensitivity at high temperature to the TL sensitivity at low temperature is constant roughly. There is a strong linear correlation between the  $S_{HT}/S_{LT}$  ratios and shock pressures for the oligoclase samples shocked in a range of 0 - 25.5 GPa (Fig. 3). An equation of the regression line can be written as  $S_{HT}/S_{LT} = 0.32 + 0.03P$  where P is shock pressure in GPa. A coefficient of regression is of 0.99. The measurements of the induced TL sensitivity can be used for estimations of shock pressures up to 25.5 GPa in shocked rocks and meteorites. We hope to apply this method by a further study of shock metamorphism in ordinary chondrites [4].

**References:** [1] Ivliev A.I. et al., (1992) LPSC XXIII, p.589; [2] Ivliev A.I. et al., (1993) LPSC XXIV, p.699; [3] Nikolaev V.I., Rusakov V.S. Messbauerovskye issledovaniya ferritiv (1985), MGU (in Russian); [4] Stoffler D. et al., GCA, v.55. p.3845.

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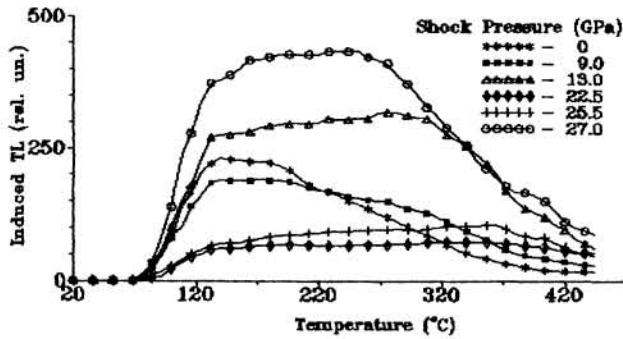


Fig. 1. Induced glow curves from the oligoclase series before and after shock loading.

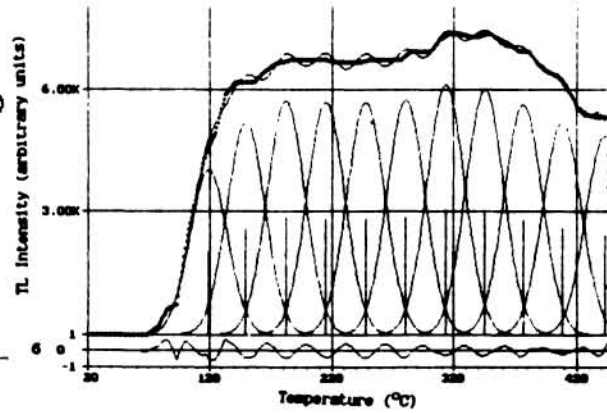


Fig. 2. Results of calculation 11-th Gauss peaks for glow curve of oligoclase shocked at 22.5 GPa. (+ experimental glow curve; solid line - theoretical curve)

Table 1. Mean values of FWHM and peak temperature for the shocked oligoclase samples

Pressure (GPa)	FWHM (°C)	Peak Temperature (°C)			
		Peak 3	Peak 4	Peak 8	Peak 9
0	32.8±0.6	176±2	206±2	330±2	362±2
9	32.6±0.6	183±3	213±3	336±3	367±3
13	33.3±0.5	181±2	212±1	336±1	367±1
22.5	35.4±0.4	183±1	215±1	344±1	375±1
25.5	35.5±0.2	182±2	214±2	340±1	371±1
27	32.4±0.5	181±1	211±1	333±1	364±1
Mean					
±1	34.6±1.3	181±2	212±2	339±5	370±5

Table 2. Mean values of the total TL sensitivity for the (3+4) - ( $S_{LT}$ ) and (8+9) - ( $S_{HT}$ ) peaks and their relation

Pressure (GPa)	TL sensitivity (unshocked $S_{LT}=1$ )		
	$S_{LT}$	$S_{HT}$	$S_{HT}/S_{LT}$
0	1.00±0.03	0.36±0.03	0.36±0.02
9	0.90±0.04	0.50±0.05	0.55±0.03
13	1.59±0.10	1.25±0.01	0.78±0.03
22.5	0.33±0.01	0.35±0.003	1.06±0.03
25.5	0.41±0.02	0.49±0.005	1.20±0.04
27	1.53±0.14	0.76±0.10	0.49±0.02

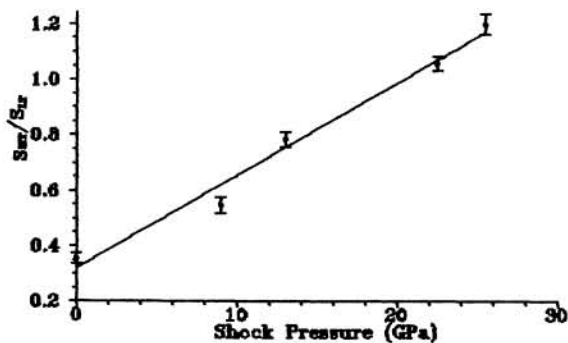


Fig. 3.  $S_{HT}/S_{LT}$  relations versus shock pressure. (Solid line obtained by the low-square method).