

Comparison between beta and ultraviolet (UV) induced Thermoluminescence in Lithium Fluoride (LiF)

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Introduction: Crystals of Lithium Fluoride (LiF) have been studied widely for several years as is one of the most commonly used Thermoluminescence dosimetric material (TLD). It is well known that LiF has several individual glow peaks observed in both low Temperatures and high Temperatures. The aim of the present study is to photo transfer (study photo transferred TL, PTTL) the electrons from deep traps (high Temperature, T) to shallow traps ($T < 400^\circ\text{C}$) using UV light. It was also examined the possibility of having UV induced TL instead of PTTL.

Experimental Procedure: The sample used in this experiment is LiF TLD-100 crystals. TL measurements were carried out using Harshaw-3500 TLD-Reader. The irradiations were applied through a $^{90}\text{Sr}/^{90}\text{Y}$ beta particle source, delivering a beta dose of 0,028 Gy/s. All measurements were performed in a nitrogen atmosphere with a low constant heating rate of 2°C/s in order to avoid significant temperature lag.

Table I: Two experimental procedures were applied in two LiF crystals:

Steps	Procedure A	Procedure B
1	Test Dose: 1,72 Gy	-
2	TL up to $T_{\max}=350^\circ\text{C}$	-
3	TD 1,72 Gy	-
4	TL up to $T=250^\circ\text{C}$	-
5	Exposure to UV for t_i	Exposure to UV for t_i
6	Repeat steps 3, 4 and 5	Repeat Step 5

Where $t_i = 1\text{min}, 2\text{min}, 4\text{min}, 8\text{min}, 16\text{min}, 32\text{min}, 1\text{hr}$ and 2hr .

Results and Discussion: Following are presented the results of the experimental procedure. In figure 1, on the left is the comparison between the two crystals for 32min UV with beta dose added and without. On the right is the comparison of normalized TL intensity for various times. The two figures show that beta induced TL is higher than the UV induced TL.

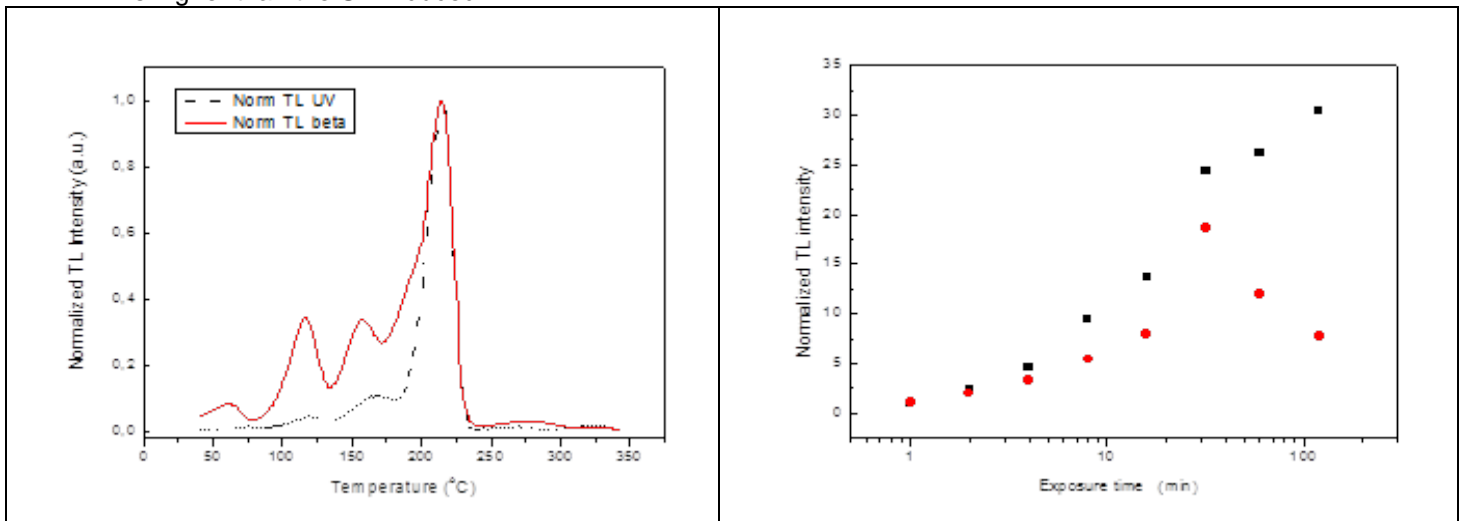


Figure 1: (left) Comparison of TL in two crystals, for $t=32\text{min}$ UV exposure, (right) Comparison of Normalized TL for various times. Red circles are for the UV exposed crystal and black squares for the Irradiated crystal.

References:

- [1] Budzanowski, M., Sas-Bieniarz, A., Bilski, P., Bubak, A., Kopeć, R., Rad. Meas, 56 (2013), 389-392
- [2] Benevides, L., Voss S., Nita. I, Rotunda J, Velbeck. K, Luo L.Z., Moscovitch M., Rad. Prot. D., 144 (2011) 199-201