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## Activation Energy and Order of Kinetics for 200°C THERMOLUMINESCENCE Dosimetry Peak in NaCl:Tb(T)

### ABSTRACT

The paper provides a detailed calculation of the activation energy and the order of kinetics of the 200°C thermoluminescence dosimetric peak in NaCl:Tb(T) material. The TLD-grade NaCl:Tb(T) phosphor was prepared by crystallization from aqueous solution and its subsequent annealing at 750°C for two hours followed by a quenching. The activation energy was estimated by two different methods namely, the peak shape method and the initial rise method. Both the methods are found to give a value around 1.3 eV, The isothermal decay and peak shape methods gave the order of the kinetics followed by the peak is 1.4 .

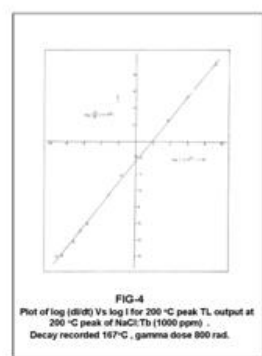
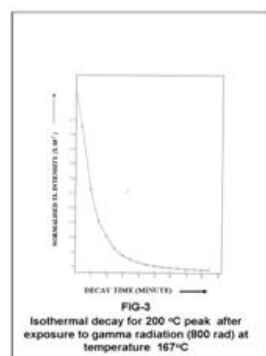
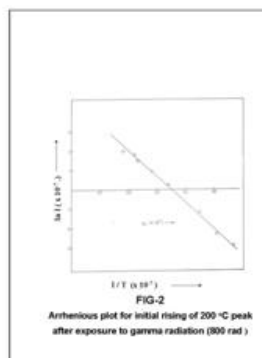
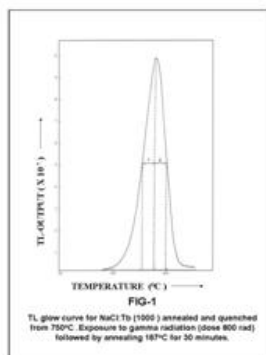
### EXPERIMENTAL METHOD

The polycrystalline specimen of NaCl:Tb(1000 ppm) was prepared by the method of crystallization from aqueous solution. The specimen thus obtained was annealed at 750 °C for two hours and subsequently quenched to room temperature in air. After irradiation with gamma dose of 800 rad, the specimen was heated at 167 °C with the heating rate of 200 °C/min. The radiation source used for excitation is <sup>60</sup>Co gamma. [6-7]

### RESULTS AND DISCUSSION

Fig-1 show typical glow curves of thermally treated and annealed and quenched NaCl:Tb (1000 ppm ) specimen. The specimen is exposed to gamma radiation .It is seen that from fig-1 that thermally treated specimen exhibits a single well defined peak at 200 °C. Initial portion at the 200 °C glow peak was recorded for the purpose of determining the activation energy.[8] The Arrhenius plot for initial rising part of 200 °C peak is presented in Fig-2. The activation energy calculated using above data was found to be around 1.3 eV. Fig-3 and 4 represent the data used for determining the order of kinetics using isothermal decay at 200°C glow peak. In present case the thermo luminescence process found to be of second order.

The appearance of well resolved 200 °C peak in the glow curve clearly indicates that the trap is single valued and that a large number of them are involved in the generation of the peak 200 °C . The well defined intense peak satisfied the basic requirement of high TL efficiency for a TLD material. The thermal activation energy for 200°C peak is around 1.3 eV. The energy value is a definite indication of the stability of the glow peak. Thus the high stability is found to have been satisfied in the present material. The isothermal decay and peak shape methods gave the order of the kinetics followed by the peak is 1.4. These experimental facts suggested low fading and high stability of the 200°C glow peak



### CONCLUSION

The value of activation energy and order of kinetic of 200°C peak for NaCl:Tb(T) phosphor suggest low fading and high stability. Thus the basic consideration have been satisfied in NaCl:Tb(T) TLD material.

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