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Thermoluminescence of Natural Salt extracted from the Saline spring of Ningel, Manipur

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Abstract

Glow curves of γ -irradiated natural salt extracted from the saline spring water of Ningel, Manipur, has been analyzed by decoding the glow curves of the natural salt using Computerized Glow Curve Deconvolution and Various Heating Rate methods. All the glow curves measured for different γ-irradiation doses and heating rates appear to be a single peak but the broad peaks are found to be multi peak. The glow curves can be deconvoluted into three constituent peaks. The traps depths of are found in the energy range 0.70 to 1.38 eV and frequency factor in the order of 10^8 to 10^{13} s^{-1}.

Key words: Trapping parameter, Meitei Thum, Thumkhong.

1.INTRODUCTION

Alkali halides are known to be sensitive thermoluminescence phosphors. The emission of alkali halide is known due to radiative recombination of halogen atoms thermally related from interstitial position with F-centers [1]. Recently, strong orange emission at ~ 490nm has been reported to be present in most NaCl sample [2]. One interesting point in the thermoluminescence spectra of NaCl is that the light emitted at each peak in the glow curve has its own wavelength [3-4]. The use of NaCl based material as a suitable candidate for TL/OSL dosimeter has been claimed by many workers [5-9]

Keeping these facts in mind we have collected salty water from Ningel Thumkhong (saline spring), one of the important sources of salty water in Manipur. The salt well of Ningel (Ningel Thumkhong) was developed during the reign of King Puranthaba (1247-1263 A.D.). During Maharaja Gareebaniwaz in 1736 A.D. saline water were collected through the wooden pipes bored deep inside the spring which is known in Manipuri as "Thumkhong Hutpa". It is evident that Ningel was the biggest market of natural salt known as Meitei Thum (Manipuri salt) till the reign of Maharaj Gareebaniwaz. Still now this salt (Meitei Thum) is consumed by the women after child birth indicating it contains many healthy ingredients. The old and new salt sources well of Ningel is shown in Figure 1.

Fig 1: The Ningel Thumkhong from where saline water was collected.

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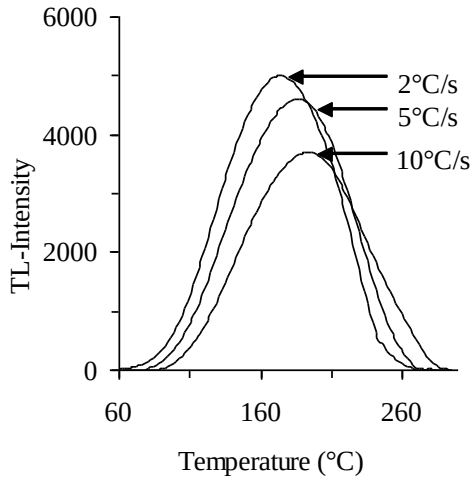

Fig 2. TL glow curves of the salt extracted from Ningel Thumkhong with different heating rates

The salt extracted from the saline water of Ningel was irradiated with different doses of γ-irradiation and the trap spectroscopy of the samples were determined by using Computerized Glow Curve Deconvolution (CGCD) and Various Heating Rate (VHR) methods.

2.EXPERIMENT

The salt extracted from the Ningel Thumkhong was irradiated to different dose of γ-ray from ^{60}Co source (5, 10, 25, 50, 75, 100 Gy) at Life Science Department, Manipur University and TL glow curves were measured by using TL Reader Model 1900I (Nucleonix System Pvt. Lt. Hyderabad) at Luminescence Dosimetry Laboratory, Thoubal College, Thoubal at different heating rate. For each measurement 20mg of the natural salt was taken and spread uniformly over the disc of the canthal strip to minimize the thermal lag at higher heating rates. A second read out was performed to record the background subtraction.

3.RESULT CND DISCUSSION

The thermoluminescence glow curves of the salt extracted from the Ningel Thumkhong irradiated at 25Gy for heating rates namely 2, 5 and 10°Cs^{-1} are shown in Figure 2. In all cases the same pattern of broad glow curves are observed with a systematic shifting of peak position from lower to higher temperature region as the heating rate increased. It was also observed that the height of the experimental main glow peak decreases with the increased of the heating rates [10].

The glow curves were subjected to CGCD within the framework of kinetic formalism [11] after thermal correction [12]. The glow curves can be decoded to three constituent peaks. The fitting of the glow curve for heating rates 2.0°Cs^{-1} is shown in Figure 3.

The trapping parameters of the sample are also calculated by using VHR method [13] to which a plot of $\ln(T_m^2/\beta)$ vs $1/T_m$ is drawn for each constituent peaks. The plot for the 3rd peak is shown in Figure 4. The result of the outcomes of the analysis compared with the mean values of the trapping parameters obtained by CGCD is presented in Table 1. The values of the trapping parameters obtained from CGCD and VHR have similar values indicating the reliability of our results. The Dose Response Curve (DRC) of the sample was found to be linear up to 100Gy which is shown in Figure 5. The XRD pattern recorded for the natural salt measured at temperature 25°C is presented in Figure 6.

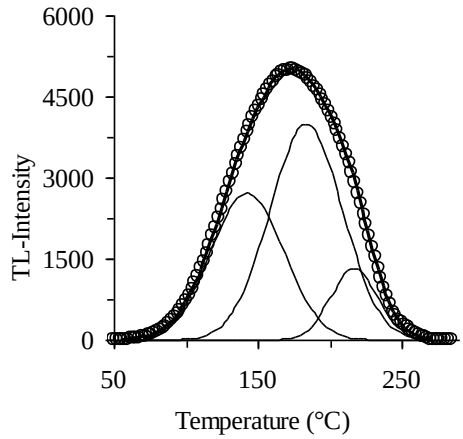

Fig 3.CGCD of salt extracted from Ningel Thumkhong for heating rate 2.0°Cs^{-1}.
oooo Experimental curve
------ Numerically generated best fit TL glow peaks.
━━ Sum of numerically generated best curves.

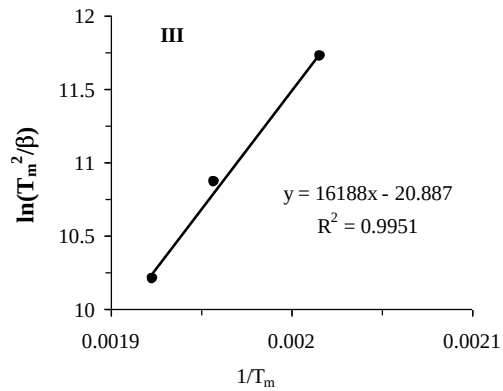

Fig 4. Plot of $\ln(T_m^2/\beta)$ versus $(1/T_m)$.

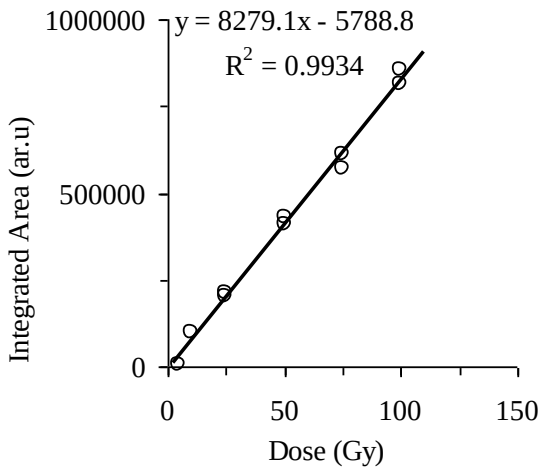

Fig 5: Dose response curve of the Salt extracted from Ningel Thumkhong.

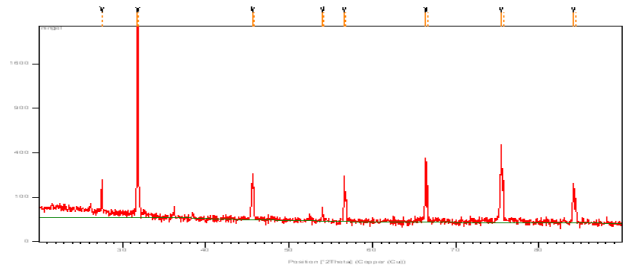

Figure 6. XRD of the natural salt extracted from the Ningel Thumkhong.

4. CONCLUSION

Glow curves of the natural salt extracted from saline spring of Ningel follows non-first order kinetics. Trapping parameters obtained by the analyses of the glow curves using two methods namely CGCD and VHR are found to be in agreement with each other with distribution of trap depths in the ranges 0.70 to 1.38 eV and frequency factor ~ 10^{8} to 10^{13} s^{-1}. The DRC of the sample is found to be linear up to 100Gy.

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References:

1. J.L. Alvarex Rivas, Journal De Physique. 41 (1980) 323.
2. N. A. Spooner, et al., J of Radiation Measurement, Vol 46 (2011) 1856.
3. G. Bonfiglioli, et al., Phys. Rev. 114 (1959) 951.
4. G. Bonfiglioli, Phys. Rev. Letters.1 (1958) 94.
5. R.V. Joshi, et al., Health Phys. 44 (1983) 29.
6. H. Nanto, et. al., Applied Physics Letters, 59 (1991)1838.
7. K. Pradip Bandyopadhyay, et al., J. of Radiation Measurement, 30 (1999) 51.
8. M.P. Chougaonkar, and P.S. Shetty, Proc.of ISLA-2011, Baroda.
9. R.M. Bailey, et al., J. of Radiation Measurement, 32 (2000) 717.
10. J.T. Randall and M.H.F. Wilkins, Proc. Roy. Soc. 184 (1945) 366.
11. K. Pradip Bandyopadhyay, et al., J. of Radiation Measurement, 30 (1999) 51.
12. M.P. Chougaonkar, and P.S. Shetty, Proc.of ISLA-2011, Baroda.
13. R.M. Bailey, et al., J. of Radiation Measurement, 32 (2000) 717.
14. J.T. Randall and M.H.F. Wilkins, Proc. Roy. Soc. 184 (1945) 366.
15. G. Kitis, and J.W.N. Tuyn, J. Phys. D: Appl. Phys. 31 (1998) 2065.
16. W. Hoogenstraaten, Philips, Res Repts.13 (1958) 517.