Available online at www.pelagiaresearchlibrary.com

Pelagia Research Library

Advances in Applied Science Research, 2014, 5(1):143-145

Pelagia Research Library

ISSN: 0976-8610
CODEN (USA): AASRFC

Determination of order of kinetics of thin films of LiF using thermo luminescence technique

[1]Suhas Moholkar and [2]Wallaree Moholkar

[1]Science College, Congress Nagar, Nagpur, Maharashtra State, India
[2]TCS Bangalore, Karnataka, India

ABSTRACT

The thermo luminescence of several thin Films of LiF has been studied. The thermo luminescence of thin films of LiF shows a prominent glow peak at 408 K and two small shoulders, one around 458 K and the other around 662 K. Chen's Formulae were used to calculate the trapping parameters for the observed prominent glow peak. It has been concluded that the thin films of LiF are monomolecular processes and they obey first order of kinetics.

Keywords: characterization, Doping, thermo luminescence, first order kinetics, monomolecular processes
PACS: *78.60. kn, Thermo luminescence; 61.72.J- Point defects and defect clusters.*

INTRODUCTION

Luminescence is the phenomenon in which a substance absorbs energy in some form or the other and re-emits a fraction of it as visible or near visible radiation [1]. Thermo luminescence is a form of luminescence that is exhibited by certain crystalline materials, such as some minerals, when previously absorbed energy from electromagnetic radiation or other ionizing radiation is re-emitted as light upon heating of the material. The phenomenon is distinct from that of black body radiation.

Thermo luminescence has become an important tool to study the color centers in alkali halides. Most of the work on thermo luminescence study of alkali halides has been confined to single crystal or microcrystalline powder. The thermo luminescence of thin films of alkali halides shows quite interesting results. In this paper an attempt has been made to report the thermo luminescence of Thin Films of LiF. The Trapping parameters are calculated for the main glow peak using Chen's formulae.

A brief review of the history of luminescence and display materials was given [2] in conjunction with a summary of the activities in the luminescence field. Thermo luminescence glow curves depend on the spatial distribution of traps and recombination centres. Trap depth and trap density [3] were found by using the thermally stimulated luminescence technique. For first order peaks, the method [4] of finding the glow parameters by measuring the shift of the maximum temperature with changing heating rate was generalized. Methods for evaluating activation energies and escape frequency factors from glow curves by the use of various heating rates were also discussed. Most of the work on thermo luminescence study of alkali halides has been confined to single crystal or microcrystalline powder. The thermo luminescence study of thin films of NaCl and KCl [5-6] were reported. Limitation of peak fitting and peak shape methods were discussed [7] for determination of activation energy of thermo-luminescence glow peaks. Optical properties of thin films[8-11] of different materials have been studied by different workers. Monte Carlo

calculations [12] were performed for thermo luminescence and trap assemblies. A mechanism for the long-duration phosphorescence has been studied by evaluating the energy level and the density of the traps generated by the auxiliary activators. Nowadays nano crystalline, nano particle thin films [13-16] are also studied by many workers. In this paper the thermo luminescence of thin films of LiF has been reported to determine order of kinetics.

MATERIALS AND METHODS

LiF Thin Films

The pure LiF powder of GR grade (Sarabhai Chemicals Comp) was used as a starting material. The Thin films of LiF were grown by Vacuum deposition technique. The Pressure was of the order of 0.15 to 0.20 micron and the substrate used was aluminum foil (New Indal Foil, super strong). The substrate temperature was maintained around 523K (±5K), using a Digital temperature Indicator (Indotherm -700). After deposition, the thin films were annealed in vacuum for about an hour. These freshly prepared thin films of LiF were exposed to γ rays from Co^{60} source for 45 minutes. The irradiation dose rate was 8000 rad/Hr.

Thermo luminescence Recordings

The thermo luminescence glow curves of the irradiated thin films of LiF were recorded using TLD Reader System [17]. A linear heating rate of 491.75K/Min coupled with a chart speed of 2.5cm/min was employed. The thermo luminescence was detected by EMI 9514 S Photomultiplier tube using DIGILOG OMNISCRIBE two pen recorders. A constant Nitrogen flux was circulated through the photomultiplier housing, during all the thermo luminescence recordings. The thermo luminescence of several thin films of pure LiF grown under similar conditions was recorded .The thermo luminescence of thin films of LiF showed quite interesting results.

The following Figure 1.represents the thermo luminescence of thin films of LiF.

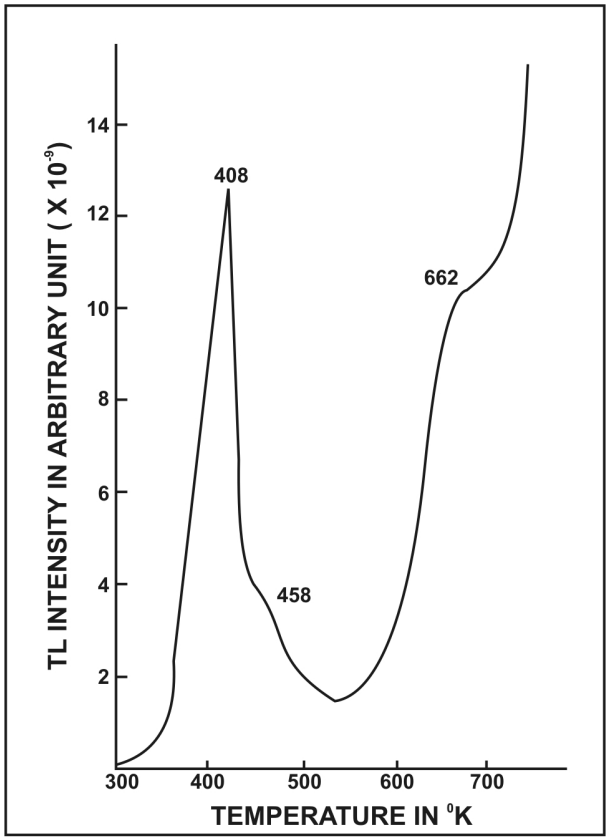

Figure-1 TL Glow curves of thin films of LIF

The following Table shows Trap Depth Values (in eV) for the glow peaks of the thin films of LiF using Chen's formulae [18-20]

Thin Film	Tm	T1	T2	T	δ	w	μg	ET	E δ	Ew
LiF	408 K	380 K	428 K	28 K	20 k	48 k	0.4167	0.6582	0.6825	0.6926

RESULTS AND DISCUSSION

The thermo luminescence of the several thin films of LiF grown under same conditions was recorded. The figure (a) shows the thermo luminescence glow curves of the thin films of LiF.

A prominent glow peak at 462K, a small peak at 386K and a small shoulder around 614K were observed in all the recordings. The trapping parameters were calculated using Chen's formulae for the main glow peak at 462K.Table – I. Thermo luminescence of the thin films of LiF showed new and interesting results. From the table it is clear that the thin films of LiF are monomolecular processes and they obey the first order kinetics.

Acknowledgements
The author wishes to thank S.B. Khasare D.Sc., Department of Physics, Science College Congress Nagar, Nagpur for his inspiring comments and fruitful discussion

REFERENCES

[1] Neelamegam P, Rajendran, *Bulletin of Material Science* © Indian Academy of Science **2001**, 26, 5, 565.
[2] Chen R, Lockwood D, *Journal of the Electrochemical Society*, **2002**, 149, 9, S69-S78.
[3] Katsumata T, Toyomane S, Tonegawa A, Kanai Y, Kaneyama U, Shakuno K, Sakai R, Komuro S, Morikawa T, *Journal of Crystal Growth*, **2002**, 237–239,361
[4] Chen R, SAA Winer *Journal of Applied Physics*, **1970**, 41, 5227.
[5] Suhas Moholkar *Advances in Applied Science Research***, 2012**,3(4),2280
[6] Suhas Moholkar *Advances in Applied Science Research*, **2012**,3(5),2921
[7] Sunta, C.M, Feria, Ayta W.E, Piters T.M, Watanabe S, *Radiation Measurements*, **1999**, 30, 197.
[8] Srikanth S, Suriyanarayanan N, Prabhakar S, Balasubramanian V, Kathirvel D, *Advances in Applied Science Research* **2011**, 2 (1) , 95.
[9] Arbad B, Dappadwad U, Bhuse V, *Advances in Applied Science Research* **2011**,2 (5), 173.
[10] Jeroh M, Okoli D, *Advances in Applied Science Research* **2012**, 3 (2), 793.
[11] Ezenwa I, *Advances in Applied Science Research* **2012**, 3(2), 980.
[12] Mandowski A, Swiatek J, *Radiation measurement*, **1998**, 29,415.
[13] Hilary Uche Igwe, Emmanuel I, Ugwu, *Advances in Applied Science Research* **2010**, 1(3), 240.
[14] Marathe Yogesh V, Shrivastava V, *Advances in Applied Science Research* **2011**, 2(3), 295.
[15] Mane Santosh T, Pingale Pandurang C, Kamble Shrishail S, Karande Vikram S, Deshmukh Lalasaheb P, *Advances in Applied Science Research* **2011**, 2 (5), 8.
[16] Agbo P.E, *Advances in Applied Science Research* **2012**, 3 (1), 599.
[17] Samanta R.K, Kumar P.V, Khatri D.T, Nambi K.S.V, *Indian Association for Radiation Protection*, **1974**, Paper no. IARP 3, 156,
[18] Chen Reuven, *Journal of Electrochemical Society*, **1969**.116, 1254.
[19] Chen Reuven, *Journal of Applied Physics*, **1969**, 40 2, 570.
[20] Shenker D, Chen R, *Journal of Computational Physics*, **1972**, 10 2, 272.