

Thermoluminescence Study of Ceramic Tiles Materials

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Abstract

The present paper reports the thermoluminescence(TL) study of Feldspar and Zircon minerals collected from the ceramic tiles manufacturing unit, Morbi, Gujarat. The natural thermoluminescence (NTL) as well as artificial thermoluminescence (ATL+NTL), by giving a 1KGy beta dose, was recorded for the collected samples. These mineral powders were annealed and quenched from 425°C followed by 1KGy beta dose given from Sr-90 beta source and then the thermoluminescence was recorded. The initial TL results of Feldspar and Zircon were quite interesting.

Keywords: Thermoluminescence, Feldspar and Zircon minerals, Ceramic technology ATL- Artificial Thermoluminescence, NTL- Natural Thermoluminescence.

1. INTRODUCTION

Many natural mineral are used to manufacture floor tiles for household floorings. The demand of a various type of ceramic products are increasing day by day in the world .In India the ceramic industry is one of the fastest growing industries, more then 500 manufacturing units of ceramic tiles, vitrified tiles and sanitary wares are situated at Morbi (Rajkot District, Gujarat state, India). Many natural minerals are used as the raw materials for the manufacturing ceramic wares. The minerals used in manufacturing the ceramic tiles are Quartz, Feldspar, Zircon, Talc, Frit-O, Frit-T, Aluminium oxide, Sodium trypoly phosphate China clay, Bikaner clay, etc. Most of the minerals are from mines in Gujarat and few are from Rajasthan state and imported from Russia. The phenomenon of TL has been studied by many investigators . The thermoluminescence (TL) study in geology, particularly for natural minerals, is an important research tool. The TL study of minerals commonly used in ceramic tiles industry, such as Feldspar and Zircon gives better understanding about their properties. The systematic study of TL of such minerals is helpful to solve the basic raw materials quality problem the ceramic tiles industries.

2. EXPERIMENTAL

The natural minerals used in manufacturing ceramic tiles are collected from the Tiles industry. TL of these minerals was recorded using TL set-up supplied by Nucleonix Systems, Hyderabad [1]. Irradiation was carried using Sr-90 beta source

3. RESULTS AND DISCUSSION

In Figure 1 the curves A, B and C represent the natural thermoluminescence (NTL), NTL+ATL and TL of Feldspar annealed, quenched from 425°C and treated with a beta ray dose of 1KGy, respectively. From fig.1, it is noted that in the curve- A, NTL is observed around 308°C. However, when the Feldspar mineral is subjected to 1KGy beta ray dose two well resolved TL peak is observed at 120°C and 265°C. When the Feldspar mineral is annealed and quenched form 425°C followed by 1KGy beta dose a well resolved high intensity TL peak is observed at 140°C,

however, the peak at 315°C disappears. As per the literature the peak at 140°C in Feldspar is the TL dating peak .

Figure 2 shows the curves A, B and C, which are the natural thermoluminescence (NTL), NTL+ATL and TL of Zircon annealed, quenched from 425°C and treated with a beta dose of 1KGy, respectively. From fig. 2 it is noted that for the curve- A not much NTL was observed except a little TL emission around 330°C. However, in the case of the Zircon mineral subjected to 75Gy beta ray dose a well resolved TL peaks are observed at 106°C and 313°C. When the Zircon mineral is annealed, quenched form 400°C followed by 1KGy beta ray a well resolved high intensity TL peak is observed at 106°C, however, the peak at 350°C disappears. As per the literature the peak at 106°C in Zircon is the TL dating peak .

Fig.-1

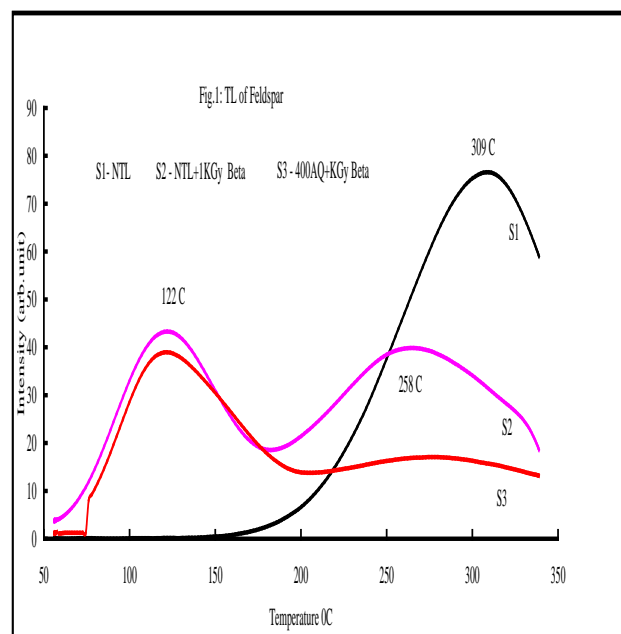
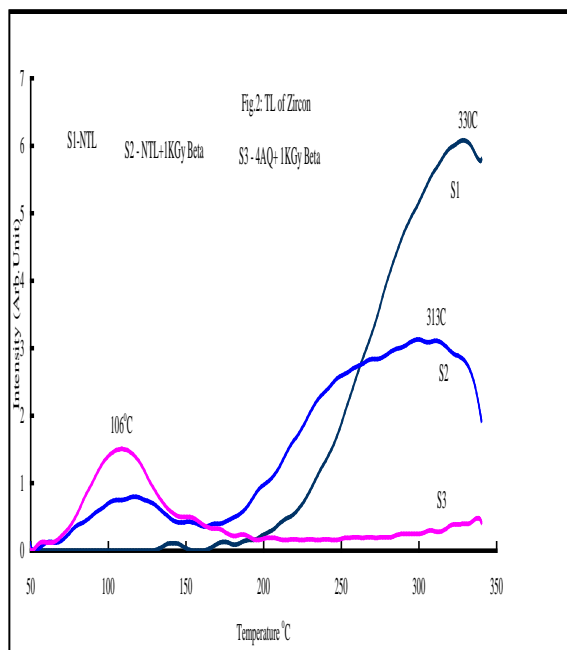


Fig.-2



7. S W S McKeever , M S Akselrod and B G Markey , 1996 *Radiation .Prot. Dosim.* **65** 267.
8. S.Kumar, Source Book of Ceramic, 1998.

4, CONCLUSION

The natural TL [NTL], NTL+ATL observed in both the minerals under study. This confirms the minerals formed are very old and the minerals is not exposed to sun light and other environmental conditions. TL observed from annealed and quenched form 425°C followed by beta irradiation leads to the conclusions this may be due to traps formed due to irradiation as well as heat treatment subjected to the mineral. The systemic TL study may be more useful in checking the purity of the raw materials which is helpful in an improving the quality of ceramic tiles in ceramic industries.

References:

1. K.V.R. Murthy and J.N. Reddy, Thermoluminescence basic theory application and experiment , Feb.2008, Pub. Nucleonix, Hyderabad.
2. K V R Murthy , Y S Patel , A S Sai Prasad, V Natarajan , A G Page , 2003 *Radiation Measurements* **36** 483.
3. K V R Murthy, S P Pallavi, R Ghildiyal, M C Parmar , Y S Patel , V Ravi Kuma, A S Sai Prasad V Natarajan , A G Page , 2006 *Radiation Prot. Dosim.* **120** 238.
4. K V R Murthy , S P Pallavi , R Ghildiyal , Y S Patel ,A S Sai Prasad , D Elangovan, 2006 *Radiation Prot. Dosim.* **119** 350.
5. S W S McKeever , 1985 *Thermoluminescence of Solids*, Cambridge University Press, Cambridge, 205.
6. M J Aitken , 1974 *Physics and Archaeology*) Oxford, U.K.: Oxford Univ. Press.