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Thermoluminescence study of natural minerals used in ceramic tiles industries

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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 100Gy beta dose, was recorded for the collected samples. These mineral powders were annealed and quenched from 400°C followed by 100Gy 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 and further studies are in progress.

KEYWORDS

Thermoluminescence;
Feldspar and zircon minerals;
Ceramic technology.

INTRODUCTION

Many natural mineral are used to manufacture floor tiles for household floorings. The demand of a variety of flooring materials has lead to develop various types of ceramic tiles. In India the ceramic industry is one of the fastest growing industries, more then 200 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, Frito, Fritt, 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.

EXPERIMENTAL

The natural minerals used in manufacturing ceramic tiles are collected from the industry. Most of the mate-

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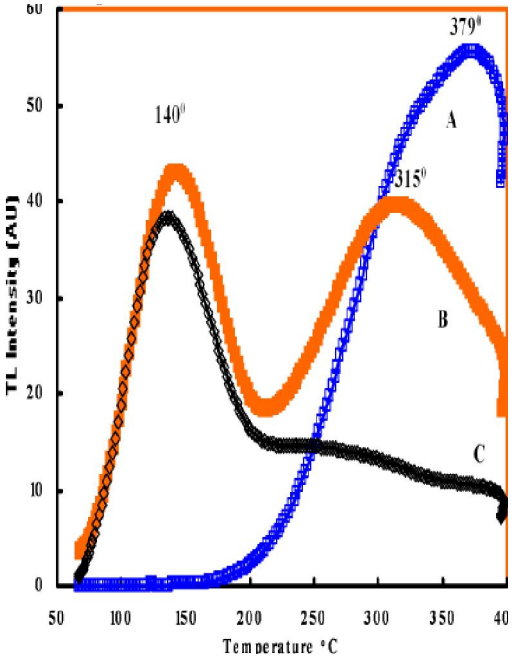

Figure 1 : The curves A, B and C represent the natural thermoluminescence (NTL), NTL+ATL and TL of feldspar annealed, quenched from 400°C and treated with a beta ray dose of 100Gy, respectively

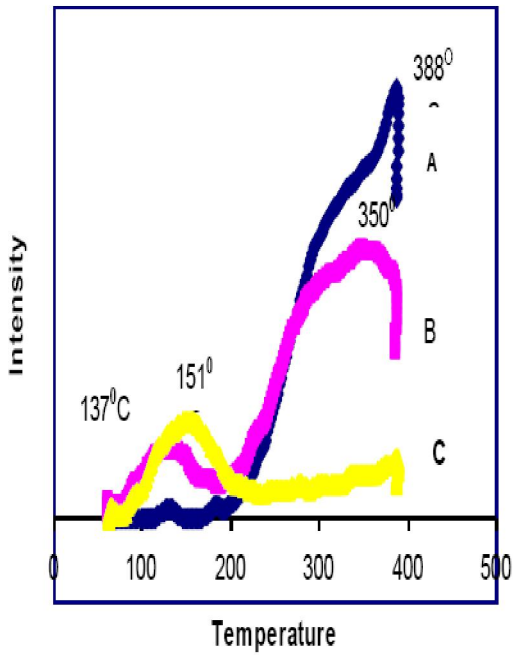

Figure 2 : The curves A, B and C, which are the natural thermoluminescence (NTL), NTL+ATL and TL of zircon annealed, quenched from 400°C and treated with a beta ray dose of 100Gy, respectively

rials used for the TL analysis were indigenous ones and a few were imported minerals. TL of these minerals was recorded using TL set-up supplied by Nucleonix Systems, Hyderabad[1]. Irradiation was carried using Sr-90 beta source. Equal quantities of samples (5mg) were used for the analysis.

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 400°C and treated with a beta ray dose of 100Gy, respectively. From figure1, it is noted that in the curve a not much NTL is observed except a little TL emission around 379°C. However, when the Feldspar mineral is subjected to 100Gy beta ray dose two well resolved TL peak is observed at 140°C and 315°C. When the Feldspar mineral is annealed and quenched form 400°C followed by 100Gy beta ray 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[5-8].

Figure 2 shows the curves A, B and C, which are the natural thermoluminescence (NTL), NTL+ATL and TL of Zircon annealed, quenched from 400°C and treated with a beta ray dose of 100Gy, respectively. From figure 2 it is noted that for the curve A not much NTL was observed except a little TL emission around 388°C. However, in the case of the Zircon mineral subjected to 100Gy beta ray dose a well resolved TL peaks are observed at 137°C and 350°C.When the Zircon mineral is annealed, quenched form 400°C followed by 100Gy beta ray dose, a well resolved high intensity TL peak is observed at 151°C, however, the peak at 350°C disappears. As per the literature the peak at 151°C in Zircon is the TL dating peak[5-8].

CONCLUSION

The natural TL [NTL] observed in both the minerals under study as well as NTL+ATL followed by the TL observed from annealed and quenched form 400°C followed by beta irritation 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 study may be more useful in checking the purity of the raw materials which in turn leads to improving the quality of ceramic tiles in ceramic industries. Further studies are in progress.

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