EXECUTIVE SUMMARY Of THE MINOR RESEARCH PROJECT

Title : *Effect of P –Co doping in rare earth activated $CaSO_4$ Phoshor*

Luminescence is defined as the emission of light by bodies which is in excess of that attributable to black body radiation and persists considerably longer than the period of electromagnetic radiation in the visible range after the excitation ceases. Thermoluminescence is the thermal stimulation of luminescence excited by some other sources of radiation.TL has found applications in diverse fields such as archaeology, biology and biochemistry, forensic sciences, geology, radiation dosimetry, radiation physics, solid state physics, space sciences and many more, [1,2,3].

Most of the interest in TL comes from the possibility of using it in radiation dosimetry. Radiation is an important tool in nuclear and medical research programmes. Number of workers employed by nuclear industry is growing very fast. Since radiation is hazardous, it is necessary to monitor the dose to workers who are in involved in such programmes. Thus it is necessary to provide a fast, economic, indigenously developed dosimetry system to the nuclear industry for monitoring the exposures to personnels. There are number of devices used to measure radiation dose. TLD is an inexpensive and very sensitive radiation device used to measure the radiation dose. After the exposure in the field these TLD's are heated on TL reading instrument to measure thermoluminescence output. The TL output is proportional to the radiation dose it received from the fields. After their use in the field, they are calibrated with known dose and field exposure evaluated.

However, phosphors used for personnel monitoring are very few because

they have to satisfy very stringent condition. The main conditions are 1) Good tissue equivalent 2) Low fading 3) Stability 4) High sensitivity 5) Reusability.

These conditions are difficult to find in single material, so compromises are always made. There are many materials already in use, such as CaSO4: Dy, LiF TLD-100,CaF2:Dy, LiF: Mg, Cu, P. LiF TLD-100 has good energy response but poor sensitivity. CaSO4: Dy has high sensitivity but poor energy response. CaSO4:Dy has been prepared indigenously but LiF TLD-100 is still imported.

Attempts are under way to find out more and more suitable phosphors for TL dosimetry. In this context it may be noted that by and large sulphates are found to be very sensitive to ionizing radiations and yield good TL intensity [4]. Simple sulphates such as CaSO4, ;CaSO4:Dy,P; CaSO4:Dy, Ce have been studied and found to be useful phosphors. This work was undertaken to study TL in sulphate based compounds with the aim of obtaining substitutes for CaSO4:Dy by doping rare earth ions and also by using different co-dopants.

CaSO4:Dy, P is known for its dosimetric characteristics for a very long time now. In this work we have carried out a comparative study on TL intensity of CaSO4:Dy, P, Ce phosphors using two different wet chemical synthesis roots. Nobody seems to have reported this kind of study on CaSO4:Dy, P, Ce3+ phosphors and as result it may be regarded as something new. Phosphors were characterized by scanning electron microscopy, photoluminescence and thermoluminescence techniques. The two methods were found to drastically affect the TL intensity of CaSO4:Dy, P, Ce phosphors. The TL intensity of CaSO4:Dy, P, Ce prepared by co-precipitation method is less by a factor of 204 than the CaSO4:Dy, P, Ce phosphor prepared via acid evaporation method. Moreover, co-doping of P and Ce ions into CaSO4:Dy was observed to enhance the thermoluminescence intensity by a factor of 1.11 than the standard phosphor in case of phosphor prepared via acid evaporation method. Surface morphology resulted through to different synthesis routes was also studied. Structures like broad metal slabs were observed for CaSO4:Dy, P, Ce phosphors using acid evaporation methods. We hope that this study may prove very helpful in selecting a preparation method for CaSO4:Dy, RE phosphors

especially when better TL properties and good crystal grain size are desired. We also think that acid evaporation method is always a better choice to prepare CaSO4:Dy, RE phosphors than co-precipitation method.

Effect of different rare earth co-activated in CaSO4:Dy, P phosphor prepared by acid distillation method. For characterisation of phosphors scanning electron microscopy (SEM) , photoluminescence (PL) and thermoluminescence (TL) spectra were carried out. The SEM charecterization showed that surface morphology resulted after preparation has rod type structures with particle size in micron range. Under photoluminescence study the incorporation of different co-dopents with their characteristic photoluminescence spectra in CaSO4:Dy, P host is confirmed. Thermoluminescence (TL) property of as prepared phosphors is comparatively good though certain variations have been observed in case of some phosphors. The TL intensity of phosphors prepared is nearly 1.11 times greater than the standard CaSO4:Dy TLD phosphor.

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Dr. M.S. Atone
Principal Investigator

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