Thermoluminescence of metallic oxides. Development and applications in Mexico: An overview

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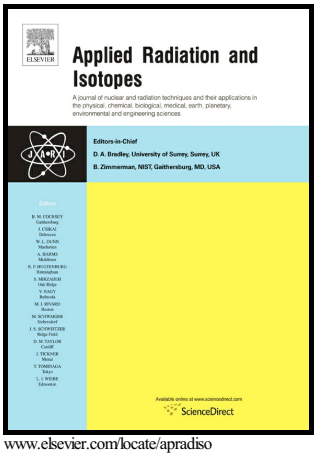

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Thermoluminescence of metallic oxides. Development and applications in Mexico: An overview

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Abstract

Interest in the study of the thermoluminescence of metallic oxides doped with various elements has been steadily increasing due to the characteristics of these materials and their possible applications in the dosimetry of ionizing radiation. Metal oxides such as zirconium oxide (ZrO_2), aluminum oxide Al_2O_3, titanium oxide (TiO_2), hafnium oxide (HfO_2) and beryllium oxide (BeO) are very interesting semiconductor materials having a wide band gap with different important applications. Since 1998, in our country we have developed these materials un-doped and doped with various elements, using different preparation methods. These materials have been obtained in powder form, thin films or in pellets made by mixing the TL powder with PTFE. Thermoluminescent and dosimetric characteristics of these materials have been studied and have been used successfully in various applications. It is presented an overview of the development of these materials in Mexico for the past 20 years.

Keywords*: Thermoluminescence; Metallic oxides; Dosimetry*

Introduction

Thermoluminescence (TL) is the thermally stimulated emission of light from an insulator or a semiconductor following the previous absorption of energy from ionizing radiation. TL dosimetry is used in many scientific and applied fields such as medical physics (radiotherapy, radio diagnostic, nuclear medicine), radiation protection, industry, as well as environmental and space research, using many different materials. The basic demands of a TL dosimeter (TLD) are good repeatability, high sensitivity and low hygroscopicity, for very low dose measurements, and good response at high doses in radiotherapy and in mixed radiation fields (Furetta, 2003; Azorin, 2012).

Thermoluminescence (TL) dosimetry has become a reliable and routine method for measuring ionizing and non-ionizing radiation, and many materials in solid form (pellets, powders and films) have been employed (Azorin, 1990; Azorin et al., 1990; Wang et al., 1986). Various methods to synthesize TL materials have been reported, based on traditional approaches to modify the band structure of the materials as well as the characteristics of their trapping centers (Reisfeld et al., 2000; Debelo, 2012; Delise et al., 2014; Azorin, 2016).

The search for new TL materials with more and better useful properties for use in radiation dosimetry, has resulted in the formation of research groups for the