First Latin-American Congress
on Solid State Dosimetry and Radiation Measurements
13-17 September, 2021

A REVIEW OF OSL DOSIMETERS FOR *IN VIVO* DOSE MEASUREMENTS IN RADIOTHERAPY

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Introduction: OSL (Optically Stimulated Luminescence) dosimeters are based on luminescent emission from passive detector materials. The luminescence emission or OSL signal is detected through a readout system equipped with a stimulation luminous source and an appropriate optical detection window. From a physical point of view, the ionizing radiation transfers energy for electrons (or holes) in the OSL material, these electrons can be trapped in metastable states of energies in the material. Using optimal optical stimulation, the trapped electrons are released. A recombination process resulting in an OSL signal that is related to absorbed dose by the sensitivity material detector exposed to ionizing radiation [1].

Considering the radiotherapy treatments, *in vivo* dosimetry is used in clinical practice to check the dose delivery to the patient. Also *in vivo* dosimetry, as supplementary to a good clinical quality assurance program, can be an useful tool to understand the failure modes in treatment delivery, increasing the attention to the safety and quality, being the gains an *in vivo* dosimetry program generate with relatively low cost per patient [2].

Considering the advances of OSL technique, in this literature review we search for studies in Science Direct database, with potential or direct application of OSL dosimeters *in vivo* dose measurements in radiotherapy.

Material and method: We use of ScienceDirect's database [3] to get an overview of the state of art in the use and production of OSL dosimeters for *in vivo* dose measurements in radiotherapy. The research was narrowed down by using the keywords and boolean operators: OSL AND radiotherapy AND "*in vivo*"; and it only included research and review articles from the last 10 years. Using the strategy described, we selected 14 of the 74 articles. The articles that do not mention OSL or those that were not considered with a potential use in radiotherapy were excluded from this review.

Results: Among the studies chosen, there are five papers that characterise OSL detectors using similar beams to the beams used in radiotherapy treatments. The OSL detectors from these studies were the OSL detectors based on Al_2O_3:C commercial powder from Landauer Inc., OSL/TL phosphate glass doped with BaO and Li_2O, Al_2O_3:C with polymers coupled to optical fibers, dosimeters composed of optical fibre of SiO_2 doped with Ge and OSL dosimeters made of Eu:BaFBr and Ce:CaF_2 connected to optical fibres.

Amid the nine articles considered with potential applications in radiotherapy, two of them study the dose measurements out-of-field for patients with implants in radiotherapy treatments, three are about the TSEB treatment, three authors use 2D dose measurements or 2D mapping, one of them had irradiations using a dedicated magnetic resonance (MR) equipment and one article is about the angular dependence of the Al_2O_3 OSL detectors in a magnetic field.

Conclusions: Although most dosimeters are still based on Al_2O_3; in the last 5 years, several other OSL materials and shapes are being studied and presenting satisfactory results to be applied in radiotherapy. New dosimeters can promote the development of different non-commercial readout systems, which can contribute to the growth of the dosimetry technology.

Especially for *in vivo* applications, optical fibres are worth mentioning as the structure can guide and measure the dose, which can enable an integrated detection and reading system that can be applied in real time.

References:

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