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Characterization of thermoluminescence properties of eye glasses for applications in retrospective / accidental dosimetry

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Introduction
Retrospective/accidental dosimetry, seeks for materials that can be used as probes for the dose assessment, when there is no other available data, from personal or environmental monitoring, during nuclear accidents. When there is uncontrollable release of radiation, it is important to determine the dose of the exposed population, in order to take the corresponding measures to reduce the health risk.

Several methods can be employed for retrospective dosimetry, such as Electron Paramagnetic Resonance (EPR), Thermoluminescence (TL) and Optically Stimulated Luminescence (OSL). TL exhibits unique characteristics, since it can provide additional information for the materials examined, revealing properties that could not have been studied with another technique. However, TL can only be applied to heat-resistant materials. Thus, common heat-resistant objects would constitute an optimal choice for their potential use as accidental dosimeters.

In this context, a large variety of ubiquitous materials has been investigated with TL. Among them, glass displays of mobile phones [1,2], watch glasses [3] and window glasses [4] have been investigated, exhibiting promising properties. Recently, glass containers of pharmaceuticals have been studied, for post-sterilization purposes [5].

Materials and Methods
The scope of this study is to investigate the potential use of eye glasses as probes for retrospective dosimetry. Based on the heat resistance of the glasses, the study is conducted with TL, using a Risø TL/OSL reader (model TL/OSL DA-15). All measurements were performed in a nitrogen atmosphere with a low constant heating rate of 2 oC/s, to avoid significant temperature lag, while the applied doses varied between 100 mGy and 16 Gy.

Results
The main luminescence properties have been explored in the present study, such as sensitization, dose response and fading. In addition, a dose recovery test has been conducted. During this test, an "unknown" dose was delivered to the samples and TL was used in order to recover the value of the dose. It is evident, that eye glasses exhibit excellent TL properties, and the exposure dose can be successful recovered, after an accident.

An intrinsic background signal is often present in the glass samples even without the exposure of the material in radiation, and usually originates from the fabrication process. As suggested in previous studies [2], this signal can be erased or reduced by chemical etching of the glass surface. Therefore, a chemical pre-treatment protocol is also investigated in the present study.

Conclusions and Future work
The exhibited TL properties of the eye glasses confirm their potential application for dosimetric purposes. Further investigation is necessary regarding the complete bleaching of the intrinsic background signal. Moreover, OSL may also be studied.

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