

BRAZILIAN BIOMINERALS FOR HIGH-DOSE DOSIMETRY

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Introduction: The study of the dosimetric properties of biominerals such as coral reef, oyster shell and mother-of-pearl samples has shown that they present good properties as promising materials for ESR dosimetric applications (Hassan and Sharaf, 2005). These materials may be of interest for: (1) Radiation dosimetry for radioprotection, medical diagnoses and nuclear medicine, and (2) Geological applications such as dating and the study of the properties of minerals and rocks. The main compound of these biominerals is calcium carbonate (CaCO_3) (Sunta, 1985). CaCO_3 is found in two microcrystalline forms, mostly aragonite, and it can be found in calcite form too (Ikeya, 1993). In addition to these constituents, there are trace amounts of Mn^{2+} , Pb^{2+} , Ce^{3+} , $(\text{UO}_2)^{2+}$, Dy^{3+} , Sm^{3+} , Tb^{3+} , Nd^{3+} , Eu^{3+} that are responsible for the luminescence of calcite and a radiation-induced center of violet emission (Marfunin, 1979).

In the present work, the dosimetric thermoluminescent properties of gamma induced centers in marine coral reef, oyster shell and mother-of-pearl were compared.

Materials and Methods: The samples of coral reef, oyster shell and mother-of-pearl (or nacre) material were powdered and sieved, retaining the $177\mu\text{m} - 74\mu\text{m}$ size fraction. The samples were thermally treated at $300^\circ\text{C}/1\text{h}$ and kept in the dark until the TL measurements were performed. After the treatments all samples were irradiated at room temperature using a ^{60}Co panoramic source of the Center for Radiation Technology. For the TL fading study of all samples, they were previously irradiated to 20Gy. The TL measurements were taken using a Harshaw Reader TL model 3500 in the range from 50° to 400°C . All TL measurements were obtained with a linear heating rate of $10^\circ\text{C}/\text{s}$ in nitrogen flux.

Results: The thermoluminescent emission curves of the coral reef, oyster shell and mother-of-pearl samples are presented in Figure 1. The peak temperature in the glow curves is around 200°C for all samples.

Figure 2 shows the TL dose-response of the biominerals at room temperature over a range from 10Gy to 100Gy. The dose-response curves suggest a linear function with a tendency to supralinearity. The maximum standard deviation for the dose response curves was 5.8% for mother of pearl samples.

Conclusion: The preliminary results of this study show the potential use of these biominerals as dosimetric materials for TL dosimetry. The results

about their stability, reproducibility, linearity to high doses, fading and lower detection limits will be presented.

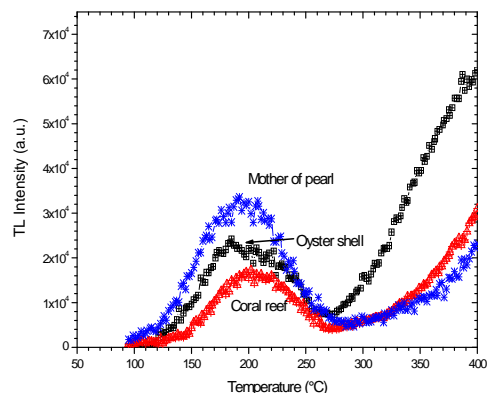


Figure 1: TL glow curves of the biomineral samples irradiated with ^{60}Co (100Gy).

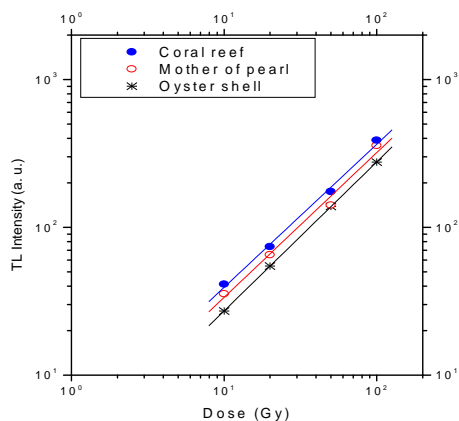


Figure 2: Dose-response of the biomineral samples.

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