

Some optical properties of biominerals

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Calcium carbonates are materials found abundantly in the nature as minerals and biominerals. In both cases calcite and aragonite isomorphous forms can be found, where the calcite form is the most stable. In calcium carbonates (in the calcite form), calcium can be replaced by Mn and Fe and, in the aragonite form, calcium can be replaced by Sr, Pb and Zn [1]. In this work, oyster shell, coral, tiger shell and mother-of-pearl samples with predominantly aragonite isomorphous forms were studied. X-ray fluorescence measurements showed the presence of CaO, Na₂O, SrO, SO₃, SiO₂ and Fe₂O₃ elements in all samples. The results of a neutron activation analysis showed, besides of the Ca element, the presence of Mn, La, Ce, Cr, Ba, Fe, Zn elements. The presence of Mn in the coral and mother-of-pearl samples was confirmed by the electronic paramagnetic resonance technique due to Mn²⁺ transition characteristics. Optical absorption measurements were taken for all samples in the wavelength range of 190 nm to 900 nm. All of the Mn signatures are transitions from the fundamental states ⁶A_{1g}(S) to the energy states of ⁴T_{1g}(G); ⁴E_g(G); ⁴A_{1g}(G); ⁴T_{2g}(D) or ⁴E_g(D); ⁴A₂(G). The spectrometer UV-2120PC, model SHIMADZU Company, was utilized with two light beams in this study. The optical absorption measurements were carried out in powder samples with 0.177 mm of diameter, and with vegetal oil, transparent in the region of interest; they were placed between two quartz plates with 89% of transmittance in the ultraviolet region. The results show that the studied samples present amazing optical properties with good ultraviolet absorbance and with a great potential to be used even as radiation detectors.

Keywords: Calcium Carbonate; Biominerals; X-ray Fluorescence, Neutron Activation Analysis, Optical Absorption.

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References

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