

EFFECTS OF IONIZING RADIATION ON THE OPTICAL ABSORPTION SPECTRUM OF ALEXANDRITE FROM MINAS DE GERAIS (BRAZIL)

*P. O. Lardaro ¹, A. O. Silva ¹, M. C. S. Nunes ¹, R. Kunzel ², C. Ulsen ³, E. M. Yoshimura⁴,
N. M. Trindade ^{1,4}

¹*Department of Physics, Federal Institute of Education and Technology of São Paulo, São Paulo, SP, Brazil.*

²*Department of Physics, Federal University of São Paulo - UNIFESP, Diadema, SP, Brazil*

³*Department of Mining and Petroleum, University of São Paulo - USP, São Paulo, SP, Brazil*

⁴*Institute of Physics, University of São Paulo - USP, São Paulo, SP, Brazil*

Alexandrite ($\text{BeAl}_2\text{O}_4:\text{Cr}^{3+}$), a variation of chrysoberyl, is a mineral abundantly found in Brazil. Recently, it has been investigated in the dosimetry field, due its composition being the combination of two main oxides used commercially, BeO and Al_2O_3 . This research proposes to investigate the effects of ionizing radiation on the optical absorption (OA) spectrum of alexandrite from Minas de Gerais (Brazil). Optical absorption (OA) is a technique used to study optical absorption centers of a material from specific electron transitions between the energy levels. The spectrometer UV-2600, Shimadzu, in the range of 200 to 800 nm, was used. For irradiation, a Risø commercial reader was used (Model DA-20), with a beta source $^{90}\text{Sr}/^{90}\text{Y}$ (10 mGy/s) and a total dose of 10 Gy. The techniques Scanning Electron microscopy (SEM)/Dispersive Electron Spectrometry (EDS) were used to identify the mineral main phases of alexandrite. Morphological and compositional characterization of alexandrite were both carried out using a FEI Quanta 650 FEG equipped with a Bruker QUANTAX EDS analyzer. For all measurements, the samples were powdered by granulometry $>75 \mu\text{m}$. The SEM/EDS results presented phases of apatite and biotite minerals, and chromium and iron, those last two are the main compounds of alexandrite. The OA spectrum resulted in the identification of two main bands, A (509-643nm) and B (353-489 nm), and the R lines (680 nm). Band A represents the superposition of two bands due to the presence of Cr^{3+} ions at the Al_1 and Al_2 sites. By deconvolution, it could be estimated the percentage of chromium ions in both sites. For non-irradiated sample, it was estimated 22% in Al_1 and 78% in Al_2 . When irradiated to 10 Gy, it was calculated 30% in Al_1 and 70% in Al_2 , suggesting that there is a migration of Cr^{3+} ions from Al_2 to Al_1 site. This research is a work in progress.

Acknowledgements: P. O. Lardaro thanks to PIBIFSP-IFSP (#2021/SPO.0003). A. O. Silva thanks to FAPESP (#2020/15626-6). E. M. YOSHIMURA is grateful to CNPq and FAPESP (#2018/05982-0). N. M. Trindade is grateful to FAPESP (2019/05915-3) and IFSP/IFSULDEMINAS.