RADIATION-INDUCED COLOR AND DEFECTS IN MONTEBRASITE/AMBLYGINTE

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RESUMO: Gamma and neutron irradiated samples from montebrasite/amblygonite series with chemical formula LiAlPO4(Fx,OH1-x) from Brazil were investigated for radiation-induced defects and color enhancement proposes. Although the colors of the different specimens were not strongly influenced by gamma irradiation, three different irradiation-induced paramagnetic defect centers were found by electron paramagnetic resonance (EPR). The first one is an O- hole center interacting with two equivalent Al neighbors, the second is a Ti3+ electron center and the third, although Ti-related, with yet unknown microscopic structure. The latter two paramagnetic centers were identified by their hyperfine interaction due to the two low-abundant Ti isotopes 47Ti (I = 5/2; 7.4%) and 49Ti (I = 7/2; 5.4%). In addition, isolated Ti3+ centers show superhyperfine interaction with two hydrogen ions from hydroxyl neighbors. From dose dependence and thermal stability experiments it is concluded that the production of O- hole centers is limited by the available Ti - related electron centers. Thermal annealing experiments show that the O- hole centers and Ti3+ electron centers are directly connected through the radiation process. On the other hand, the concentration of O- hole centers can be increased drastically by (fast) neutron-irradiation leading also to a bluish-green color related with two absorption bands: one centered in the near UV spectral range and the other at about 580 nm. A small bound polaron related with the O- hole center may explain the color center similar as for topaz. The EPR angular rotation patterns of the irradiation-induced defects were measured and analyzed. The results suggest that O- hole centers are formed by neutrons through dissociation of the hydroxyl ions, similar as in topaz. In montebrasite, these hydroxyl ions interconnect Al ions along the c axis in montebrasite. The spin Hamiltonian parameters of the irradiation-induced defects are analyzed and compared to similar defect centers in other mineral specimens.Acknowledgements: We are grateful to FAPEMIG, CNPq and FINEP.

PALAVRAS-CHAVE: MONTEBRASITE; COLOR; IRRADIATION.