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Surface crystallization in a lead borate glass and their influence on thermoluminescence response

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PbB4O7 crystalline phase has attracted the attention of many researches due its interesting properties, which are suitable for several optical applications, such as Second Harmonic Generation (SHG). This crystalline phase is iso-structural with SrB4O7, which has thermoluminescent properties. The thermoluminescent response of these materials depends on the preparation method. The boron coordination plays an important role in SHG. In this work, we studied the crystallization kinetics of a lead diborate glass as a precursor of thermoluminescent materials. Glasses were prepared by melting at 900ºC, followed of quenching. The samples were annealed at 300ºC for release of residual stresses. Samples with dimensions of 10 x 10 x 2 mm3 were cut, polished and heat treated at 590ºC for different times in an electrical furnace, for crystallization. The crystallization was characterized by XRD and optical microscopy. The crystal growth kinetics was investigated by determining the crystallized surface fraction, the largest crystal size and the crystal number per unit area as a function of time. Infrared spectroscopy was performed to understand the modification of structural units during crystallization. Thermoluminiscence response of the glass and crystallized samples was studied. We observed the best response of crystallized samples in the range of 1 – 20 Gy.