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Development of glass-persistent composite by direct incorporation of $Sr_2MgSi_2O_7:Eu^{2+},Dy^{3+}$ into phosphate glass

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Oxide glasses are a condensed state of matter that present structural disorder from the 2nd sphere of coordination, in addition to the presence of glass transition temperature (T_g). Due to the high characteristic temperature of conventional silicate, phosphate-based glasses are studied in applications that require milder temperatures, such as for the incorporation of crystalline materials. Crystals with persistent luminescence (PeL) properties depend on a host matrix to be widely applied, which provides improved mechanical properties and chemical resistance [1,2]. The production of a 'persistent glass' by incorporation of the crystals into the glass synthesis requires the addition of PeL microparticles at temperatures above the melting temperature (T_m), which introduces the problem of corrosion of the microparticles by the melt, even using a matrix with low characteristic temperatures such as in phosphates. In this scope, the commercial blue persistent $Sr_2MgSi_2O_7:Eu^{2+}$, Dy^{3+} was incorporated into a glass matrix of composition K_2O-Li_2O-P_2O_5-Nb_2O_5 at a temperature close to the T_m of the already synthed glass. UV-vis absorption indicates the transparency of the final composite from 350 to 800 nm. Raman and SEM-FEG coupled with EDX analyzer confirm the non-interaction between the incorporated particles and the glass matrix. Additionally, micro-CT findings corroborate the homogeneous dispersion of the crystals in the glass volume mixed in a planetary mixer. The absolute persistence measurement in cd/m^2 shows the same non-interactive the luminescent behavior when compared with pure PeL microparticles. That said, the corrosivity of the matrix can be assessed by additional heat treatment varying dwell time and temperature.

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