Structure and properties of magnesium phosphate glasses modified by Fe_2O_3

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Magnesium-iron phosphate glasses were studied in the compositional series (40-x)MgO-xFe_2O_3-60P_2O_5 within the concentration range of x=0-40 mol

Raman spectra showed that the structure of all glasses is formed mainly by metaphosphate (Q^2) and diphosphate (Q^1) structural units interconnected by P-O-P bonds. The replacement of MgO by Fe_2O_3 leads to the depolymerisation of the phosphate structural network and to the partial transformation of Q^2 units into Q^1 units and finally to the isolated Q^0 orthophosphate units. The incorporation of FeO_x structural units to the parent magnesium phosphate glass results in an increase of the density, molar volume, chemical durability and refractive index of glasses whereas their Abbe number nonlinearly decreases. The replacement of P-O-P bonds by P-O-Fe(II) or P-OFe(III) bonds with increasing Fe_2O_3 content leads also to changes in thermal properties of these glasses. Increasing Fe_2O_3 content in the glasses resulted in a gradual decrease of glass transition temperature and dilatometric softening temperature whereas thermal expansion coefficient does not change significantly. The DTA curves showed that all glasses crystallize on heating in the temperature range of 560-784^{o}C, most of them in several crystallization steps. Crystallization temperature decreases with increasing Fe_2O_3 content. The lowest thermal stability and therefore the highest tendency towards crystallization were found for the glass containing 40 mol

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