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Structural Reinforcement of Nb2O5 in Soda-Lime Borosilicate Glasses for Nuclear Waste Immobilization

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The vitrification process has been used for high level nuclear waste (HLW) immobilization for more than 40 years around the word. However, there are still many difficulties involving the radiation effects in the glass matrixes as, for example, crackings that reduce their mechanical and chemical resistance. The impact of Nb2O5 addition in the CaO-Na2O-SiO2-B2O5 glass system was investigated. The glass samples, produced by melting method, were submitted to extreme chemical attacks like the alkaline ISO 695-1984 (E), the acid DIN 12116-1976 and characterized by X-ray diffraction (XRD), Fourier Transformed Infrared Spectroscopy (FTIR) and Raman Spectroscopy. XRD diffraction patterns obtained before the chemical attacks confirmed the vitreous character of the samples. Raman spectra and FTIR spectra obtained after the chemical attacks indicated that the Nb2O5 is well connected to the glass network, supported by the decrease in mass loss after the chemical attacks, as the the Nb2O5 content was raised in the samples. These results are indicative that the chemical resistance of the studied glasses can be improved by increasing the Nb2O5 content. These results show that the process is a promising alternative to produce new family of the appropriate glasses for nuclear wastes immobilization.