Niobium effect on modified silicate glass for nuclear waste immobilization

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Abstract.
Nuclear waste immobilization by vitrification process is a potential route because it allows that many elements can be incorporated into the glass and consequently the final waste volume is reduced [1]. The effect of Nb addition into the multioxide silicate glass, based in soda-lime glasses modified by B_2O_3 and Al_2O_3 additions was studied. Glass composition in the CaO-Na2O-SiO2-RxOy system [2] was chosen to be investigated. It was produced by the traditional melting method. The glass samples were characterized by X-ray diffraction (XRD), Fourier Transformed Infrared Spectroscopy (FTIR), Raman Spectroscopy and Differential Thermal Analysis (DTA). XRD diffraction patterns showed that the materials are completely amorphous. DTA analysis revealed that the glass-transition-temperature (Tg) increases by increasing the Nb content. It was verified by determination of the Hrubÿ parameter, [3] that the stability of the glass shows the same above tendency. Raman spectra and FTIR spectra indicated that the addition of less than 1 mol% of Nb to the glasses was able to promote the metaborate rings and boroxol groups content. The deconvolution of the Raman peaks showed higher intensity of the Q^3 units with the Nb content additions. The preliminary results obtained up to now are indicative that the chemical durability of the studied glasses can be improved by increasing the Nb content. These results show that the process is a promising alternative to produce new family of the appropriate glasses for nuclear wastes immobilization.

References

[1] M. I. Ojovan, W. E. Lee, Elsevier 2nd. Ed. (2015).
[2] A. C. Silva, S. C. Santos, S. R. H. Mello-Castanho, Mat. Sci. Forum. **727-728** (2012) 1496-1501
[3]. A. A. Cabral Jr., C. Fredericci, E. D. Zanotto, J. Non Crys. Sol. **219**, (1997) 182-186.