High surface niobium oxide ambigel for simulated nuclear waste immobilization

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Niobium is predominantly found in Brazil, and it is, therefore, of great interest to find new technological applications for Nb and its compounds. It has been demonstrated that porous niobium oxide glasses can be used to trap nuclear waste [1]. Glass frits require high energy processes and high sintering temperature for their production. Ambigels on the other hand can be produced under ambient conditions (~25 °C, 1 atm.) and due to their high specific area they require much lower sintering temperatures, two characteristics that attract their use as hosts for nuclear waste immobilization [2]. In this work, we produced niobium oxide ambigels intended as host matrix for simulated multicomponent liquid nuclear waste. We synthetized ambigels using niobium pentachloride ($NbCl_5$) as precursor, ethanol as solvent and nitric acid as catalyst. Following rapid gelation the gels were left to age in ethanol, passing to hexane through sequential solvent exchange until 100% hexane were reached. In the last step, the gels were dried under ambient conditions for 48 hours. We have produced ambigels with high specific surface area (> 110 m^2/g) and amorphous niobium oxide phase. The ambigels were impregnated with saline solutions that simulate a multicomponent nuclear waste. The weight gain after thermal treatment was determined and used as indicator for the amount immobilized. Nb_2O_5-based ambigels can be used as a mesoporous host matrix for nuclear waste immobilization.

[1] RAMBO, C. R. et al. Manufacturing of porous niobium phosphate glasses. **Journal of non-crystalline solids**, v. 352, n. 32, p. 3739-3743, 2006.

[2] BAY DE S., Graciano et al. Amorphous SiO_2 ambigels as hosts for simulated PWR multicomponent nuclear waste. **Journal of Non-Crystalline Solids**, v. 461, p. 67-71, 2017.