Role of Platinum Group Metals on rheological and electrical properties of nuclear glass

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Abstract

High level radioactive waste originated from nuclear fuel reprocessing are vitrified in a borosilicate matrix at 1100-1200∘C. Some elements from the Platinum Group Metals (PGM) remain insoluble during the vitrification process. This might lead to complex phenomena, such as aggregation and sedimentation of particles, and affect significantly rheological and electrical properties of the glass melt. In order to master the vitrification process, a good understanding of these phenomena is necessary.

Glass electrical conductivity increases strongly when the RuO2 content is higher than a percolation threshold, explained by a connected network of RuO2 particles, which are metallic conductors. The formation of these aggregates is favored by particles anisotropy and by some specific process conditions (temperature, mixing,...) and leads to an increase of the glass melt viscosity.

Electrical and rheological percolation laws are found to be in good agreement, and give a good description of the PGM influence on nuclear glass properties.

Keywords: nuclear glasses, rheology, electrical conductivity, noble metals

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