

**Structural role of zirconium in nuclear glass  
and in corresponding alteration gel**

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Vitrification of liquid high-level radioactive waste in borosilicate glasses has received a great attention in several countries since many years. Glass leaching by water is an important mechanism to predict the evolution of glasses used to store these wastes. Indeed, in geological repository, as glass leaching by water severely affects the long-term evolution of borosilicate glasses.

We will present some structural features of the evolution of the SON 68 glass under forcing conditions. During the alteration of the glass, an amorphous gel is formed at the surface of the glass. The durability of the gel and its properties depend on the structural role played by elements such as Zr<sup>4+</sup>. New generations of spent fuels require higher content of Zr<sup>4+</sup> in glasses. The modifications of the Zr<sup>4+</sup> environment in the gel has been investigated as a function of increasing ZrO<sub>2</sub> content from 1 to 8 mol% in simplified 5-oxide glass compositions. Short- and medium-range local environment of zirconium in these glasses was determined by Zr L-2,L-3-edge and K-edge XANES and by Zr K-edge EXAFS. These structural modifications illustrate the molecular-scale origin of the processes at the origin of the glass-to-gel transformation.