



	<b>Experiment title:</b> Vanadium coordination in silicate glasses	<b>Experiment number:</b> 08-01-212
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**Report:**

We studied the structural role of V in synthetic silicate glasses by XAS at the V k-edge. Several compounds with known V oxidation state and coordination number were used as standards: V<sub>2</sub>O<sub>4</sub> (4<sup>+</sup>, octahedron), V<sub>2</sub>O<sub>5</sub> (5<sup>+</sup>, trigonal dipyramid), descloizite (5<sup>+</sup>, tetrahedron) and vanadinite (5<sup>+</sup>, tetrahedron).

The compositions of the studied glasses represent simplified natural systems (basaltic and ferrobaltic), and were chosen in order to study the effect of glass composition and redox conditions on the V coordination number. Also a sodium-disilicate glass has been studied to see the effect of an excess alkali content on V. The glasses studied contained from 0.1 wt% to a maximum of 5 wt % V<sub>2</sub>O<sub>5</sub>.

Glasses can be considered, in a first approximation, to have the same structure of the corresponding melt at the pressure and temperature of quenching. The recent interest on the structural role of transition elements in silicate glasses (and thus in melts) arose because of their importance in controlling melt properties such as viscosity, density and refractive index. Moreover, their structural role in the melt affects partition coefficients between melt and crystals. Despite the large number of studies on the physical properties of silicate glasses, little information is available on the role of transition elements present in minor to trace amounts in the melt. In this

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work we have taken advantage of the unique capabilities of XAS to extract information on V oxidation state and coordination number as a function of glass composition, V concentration and synthesis redox conditions.

The XANES spectra show V to be pentavalent in most of the studied glasses. Comparison of the pre-edge peak intensity with that of standard compounds reveal V to be tetracoordinated. Interestingly, ferrobasaltic glasses have a smaller pre-edge peak thus suggesting a mixed [4] + [5] coordination for V. Furthermore, a ferrobasaltic glass synthesised at reducing conditions, has tetravalent V in [5] + [6] coordination.

EXAFS spectra of the more concentrated samples are currently under study.

#### References:

Barboni S., Paris E., Giuli G., Romano C. (2000)  
XANES study of vanadium in silicate glasses  
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