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Al speciation in silicate glasses and melts

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The first human glasses were made 3500 BC. It was essentially sodo-lime silicate glass. To improve the chemical resistance, the thermal properties and increase the viscosity it is interesting to add aluminum in these silicates. But what is the speciation of the aluminum and how it varies according to the chemical composition and to the temperature?
The aluminum appears essentially in four or five fold coordination in glasses and melts melted. The proportion of [5]Al varies according to the alkaline or to the earth-alkaline content and to the temperature.
We shall present in a first part the influence of the network-modifier on the proportion of [5]Al and then we shall present some new results of absorption of high-temperature using NMR and XANES spectroscopy at the Al K-edge.
Finally, from glass transition temperature measurements we propose to explain that [5]Al can be a new network former.