Evaluation and mechanisms of a surface treatment based on zinc salts to slow down atmospheric alteration

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Abstract

In the flat glass industry, zinc salts are sometimes used to protect glasses from atmospheric alteration during their transport and storage. A zinc salts based treatment could be an interesting complement to the control of the environment performed by museums to slow down the processes of alteration of ancient glass. The current research is focused on this potentiality. The protective action of zinc salts is investigated by the mean of ageing experiments (temperature and humidity control) on relevant ancient glass composition replica.
Our results put in evidence that treated glass plates develop a significantly thinner hydrated layer thickness than the untreated one at 80∘C or 40∘C (85% RH). Furthermore, zinc salts treatment modifies the nature of salts on glass surface. Different Zn(II) species are identified on the glass surface prior or after the ageing and their distribution is tracked by Tof-SIMS. Notably, the study of the Zn(II) speciation on glass surface by Grazing Incidence X-Ray Absorption Spectroscopy at SOLEIL synchrotron shows the incorporation of Zn(II) into the silicate network with the ageing.
Based on these results, several hypotheses on the protective action of Zn(II) against glass atmospheric alteration are formulated and discussed : (i) Surface acidification, (ii) Weakening of the hydrophilic character of the surface by diminishing the surface charge, (iii) Formation of a passivating zinc-hydroxy-silicate layer, (iv) Very low solubility of this layer.

Keywords: Atmospheric alteration, surface chemistry

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