
Redox coupling in glass: influence of antimony on coloring

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Abstract

Historically, multivalent elements have been used in the glass manufacturing in order to control its physicochemical properties such as the colour. The latter is defined by the final redox of the glass and the coordination of these chromophore agents. When several multivalent elements are introduced into the glass manufacturing process, they can interact with each other depending on the composition of the glass, their concentration and the synthesis conditions such as melting and annealing temperatures or the atmosphere of the furnace. These differences in behaviour between these multivalent elements are still poorly understood at the different stages of glass formation. Therefore, this work focuses more particularly on the role of antimony which can be used as an opacifier, decolourizer, or refiner in current industrial processes. This work is of both industrial and cultural interest for heritage glass. First, different syntheses of the ternary system SiO₂-Na₂O-CaO doped with different concentrations of colouring (Fe, Mn, Cu) and antimony are performed under controlled conditions. The glasses are then investigated via optical spectroscopy and EPR in order to determine the local environment of these elements and quantify the redox state.

Keywords: Silicate glass, Redox, Color, Antimony, Spectroscopy

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