Optical absorption properties of silicate glasses containing iron.

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Iron, for its UV- and heat-cut properties, is a colorant widely used by the float glass industry for automotive products. The optical absorption properties of these glasses are directly controlled by the relative amount of Fe^{2+} and Fe^{3+} produced in the glass. For instance, the usual colour of an industrial glass (melted in air) containing iron is green, but may also range from yellow (Fe^{3+}) to blue (Fe^{2+}).

In order to predict the properties of theses products, without having to melt the samples, it is necessary to make a simulation of their optical absorption spectra depending on their chemical features. However, the results depend strongly on the estimated specific absorption of each cation. In other words, the issue for a good simulation tool, is the accuracy of the Fe^{2+} and Fe^{3+} extinction coefficients.

The method provided here for the determination of these extinction coefficients is a mathematical evaluation using optical absorption spectra of glasses containing both cations simultaneously. First of all, the baseline of the spectra is measured experimentally. The results show that only reflections on sample faces are significant.

After baseline subtraction, the corrected absorbance is assigned only to Fe^{2+} and Fe^{3+} absorptions which are separated using series of glasses of constant total iron concentration but different Fe^{2+} / Fe^{3+} ratios. Considering that the two cations are structurally stable in the whole series, Fe^{2+} and Fe^{3+} extinction coefficients may be calculated by the way of a linear regression fitting of the corrected absorbance as a function of the Fe^{2+} / Fe^{3+} ratio.

Using such a statistical method yields extinction coefficients accurate enough to get a good estimation of the optical absorption properties of industrial glasses containing iron.