

# Advanced confocal Raman spectroscopy applied to high temperature dissolution problems

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Despite being of direct relevance in geology, glass science, and ceramic corrosion, quantitative predictive models of mineral dissolution rates by silicate melts are currently lacking or valid only over small ranges of conditions. By coupling measurements and modelling of crystal-melt interface chemical composition, structural characteristics of the melt, and transport behaviour (e.g. diffusion in the melt), we aim to make progress in this field.

To develop a more reliable model capable of quantifying mineral dissolution in silicate melts, a set of alumina dissolution experiments in an industrial soda-lime-silica glass was conducted at high temperatures (1300 to 1450°C) under static conditions. While these experiments were designed to better understand the conditions leading to unmolten grains in commercial glasses, the approaches developed, and the results obtained are of potential interest to planetary sciences too (dissolution of CAI in chondrules; quantification of melt-rock interaction in general). We compared electron probe micro-analysis (EPMA) compositional profiles and Raman spectroscopy mapping from the same dissolution samples. By using a Nonzero Matrix Factorization (NMF) analysis on the multidimensional spectra data, we associate the principal structural components of the melt with the compositional gradient induced by diffusion-controlled dissolution.

This method helps to decrease the spatial resolution of the EPMA profiles, especially near the interface between minerals and glass. Likewise, it extends the understanding of dissolution mechanisms to the structural level, opening new perspectives for quantitative modelling of mineral dissolution.