

V41A-4763 Matrix Effects in SIMS Analysis of Hydrogen in Nominally Anhydrous Minerals (NAMs)

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- ● *Mosccone South*
- *Poster Hall*

Accurate analysis of trace H in NAMs has become important with recognition that even small amounts of H influence geochemical and geophysical processes. FTIR and SIMS can measure concentrations down to ~1 ppmw H₂O. However, a major limitation is that they rely on standards calibrated with other methods. SIMS matrix effects for H in NAMs are poorly constrained, but are likely dominated by differences in mean atomic mass. Here we use volatile-free molar weight (VFMW) normalized to one O/mol as a proxy for this parameter [cf. 1].

Our goal is to constrain SIMS matrix effects by combining our work on olivine [2], pyroxene [3], and feldspar [4] with new data on kyanite, zircon, and 37 garnets (pyropes, grossulars, spessartines, and andradites), while critically evaluating absolute calibrations of IR absorption coefficients (ϵ_i) for H in NAMs. All of these NAMs taken together span a wider range in VFMW (~32-45) than in previous comparisons [5, 6] concentrating only on olivine, pyroxene, and pyrope-rich garnet (VFMW ~ 34-37).

Our results and conclusions include the following:

- 1) SIMS-FTIR comparisons demonstrate that ϵ_i is wavenumber dependent for feldspar, zircon, grossular, and clinopyroxene, in accord with theory and empirical calibrations on hydrous materials. On the other hand, a factor of 3 difference in ϵ_i for H defects in olivine [7] is unsupported by our data [2].
- 2) Calibration slopes (for plots of ppmw H₂O vs. $^{16}\text{OH}/^{30}\text{Si} \times \text{SiO}_2$) correlate positively with VFMW, an effect not discerned in previous work [6]. This result is also opposite to a study demonstrating a *negative* correlation for hydrous phases and glasses [1]. This discrepancy may be related to differences in analytical methods (e.g., Cs⁺ vs. O⁻ primary beam, collection of OH⁻ versus H⁺).
- 3) Scatter in the trend of calibration slopes vs. VFMW is likely due to uncertainties in ϵ_i . Another possible factor is the structure of the matrix, which can affect the kinetic energy of cascade collisions leading to secondary ion sputtering.

[1] King et al (2002) Am Min 87, 1077-1089 [2] Mosenfelder et al (2011), Am Min 96, 1725-1741 [3] Mosenfelder and Rossman (2013a, 2013b), Am Min 98, 1026-1041; 1042-1054 [4] Mosenfelder et al (submitted) Am Min [5] Koga et al. (2003), G3, 4, 1019 [6] Aubaud et al (2007), Am Min 92, 811-828 [7] Kovacs et al (2010) Am Min 95, 292-299

Authors

Jed Mosenfelder

University of Minnesota Twin Cities

George Rossman

Caltech