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New IR spectroscopic data for determination of water abundances in hydrous pantelleritic glasses

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Abstract

To aid current work on the genesis of pantelleritic magmas, and the desire to use IR spectroscopy to measure water contents in natural (e.g., melt inclusions) and experimental glasses of pantelleritic composition, we have determined molar absorptivities for near-infrared (NIR) absorption bands related to molecular water (5200 cm^{-1}) and OH groups (4500 cm^{-1}) in synthetic hydrous pantelleritic glasses, with compositions similar to natural pantellerites from the Eburru complex of the Kenya Rift Valley. The experiments were conducted at P = 30 to 150 MPa and T = 850–900 °C using a synthetic pantelleritic starting composition with (wt%) SiO_2 = 76.60, Al_2O_3 = 8.48, FeO* = 5.48, K_2O = 3.68, Na_2O = 4.72, and with molar ratio (Na+K)/Al = 1.38. The experiments were H_2O undersaturated (~1.1 to 6.5 wt% H_2O), and the run products were analyzed by Karl-Fischer Titration (KFT) for total dissolved H_2O abundance. Different combinations of baseline types (GG or TT) and intensity measurements (peak height and peak area) were applied to measure both hydroxyl group (OH) and molecular water (H_2O) in the experimental samples. For instance, evaluating the peak heights and using the TT baseline ε_{4500} results to be equal to 0.98(4) (L $mol^{-1}cm^{-1}$) and ε_{5200} to 1.92(2) (L mol^{-1} cm^{-1}); these values differ by ~20 to 50% from published values for metaluminous rhyolitic compositions.

Keywords: Pantellerite glasses, water content, NIR spectroscopy, molar absorptivities