In-situ infrared spectroscopic studies of hydroxyl in micas at high pressures

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Micas accommodate ~2 weight percent water in the form of hydroxyl, making them important carriers of water into subduction zones (Poli and Schmidt, 2002; Williams and Hemley, 2001). The presence of micas within mantle xenoliths, and previous studies of hydrous mineral assemblages at low pressures and temperatures, indicate micas are stable to depths exceeding 300 km, enabling micas to effectively transport water well into the upper mantle. The accommodation and subsequent loss of hydroxyl at high pressure is compositionally dependent, as demonstrated by previous studies of biotite, muscovite, and phlogopite within a range of mantle assemblages (Schmidt et al., 2004; Thomsen and Schmidt, 2008; Williams et al., 2012). Here we present infrared spectroscopic measurements of hydroxyl modes in a variety of mica compositions at upper mantle pressures, building upon earlier studies (Williams et al., 2012). We find that hydroxyl stretching modes in micas have pressure dependences linearly related to their 1-bar frequencies, similar to previous findings in related mineral groups (Thompson et al., 2016). The identification of this linear trend allows for the prediction of bond softening or strengthening with pressure, which may influence the response of bulk properties of the material to pressure.

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