

In situ Raman spectroscopic investigation of the structure of subduction-zone fluids up to 900 deg C and 2.3 GPa

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It is known that aqueous fluid and hydrous silicate melt become completely miscible and form supercritical fluid at P-T conditions relevant to the regions where the dehydration reactions may take place in subducting slabs [Mibe et al. (2007) *J. Geophys. Res.*]. However, the properties of these slab-derived fluids are not yet well understood. Water affects physical and chemical properties of silicate melts and supercritical fluids mainly by changing their microscopic structures. Therefore, investigation of the structures of these fluids under high P-T conditions and the formulation of a dissolution mechanism for H₂O in silicate melt are crucial for understanding the properties of slab-derived fluids in subduction zones. We conducted an in situ Raman spectroscopic investigation of the structures of aqueous fluid, hydrous melt, and supercritical fluid in the system KAlSi₃O₈-H₂O, which represents an endmember analog of the composition of experimentally determined subduction-zone fluids. Our results show that the structures of aqueous fluid and hydrous melt become closer when conditions approach the second critical endpoint (~1.5 GPa and 800 °C). Almost no three-dimensional network was observed in the supercritical fluid above 2 GPa although a large amount of silicate component is dissolved, suggesting that the physical and chemical properties of these phases change drastically at around the second critical endpoint. This kind of highly concentrated but low-viscosity fluid is expected to play an important role in transferring the materials in subducting slabs to the mantle wedge efficiently upon dehydration of hydrous minerals.