Water effects on the anharmonic properties of forsterite

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In order to quantify the effects of hydration on anharmonicity of olivine thermodynamics, we have measured *in situ* Raman spectra of an extremely hydrous forsterite with 4500 ppm (wt) H_2O at temperatures up to 1273K. All the Raman modes in hydrous forsterite shift linearly to lower wavenumbers with increasing temperature. The calculated isobaric mode Grünesien parameters related to SiO_4 internal stretching and bending vibrations are much lower than lattice vibrations. Additionally, compared with anhydrous forsterite, except for the modes at 919, 858 and 227 cm^{-1}, water greatly reduces the isobaric mode Grüneisen parameters of the Raman modes in forsterite. Water also has a large effect on the anharmonic parameters related to lattice vibrations whereas it has little effect on the anharmonic parameters related to SiO_4 internal stretching and bending vibrations. Those results have the implications to the variations of local structure with temperature and estimation of water effects on the thermodynamics of forsterite.