Correlations between the frequency shifts and the thermodynamic quantities for the $\alpha$-$\beta$ transition in quartz

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The frequency shifts are related to the thermodynamic quantities (compressibility, order parameter and susceptibility) for the $\alpha$-$\beta$ transition in quartz. The experimental data for the frequency shifts and the bulk modulus from the literature are used for those correlations. By calculating the order parameter from the mean field theory, correlations between the frequencies of various modes and the order parameter are examined according to quasi-harmonic phonon theory for the $\alpha$-$\beta$ transition in quartz. Also, correlation between the bulk modulus in relation to the frequency shifts and the order parameter susceptibility is constructed for the $\alpha$-$\beta$ transition in this crystalline system.

Keywords: frequency shifts, thermodynamic quantities, $\alpha$-$\beta$ transition, quartz