

Temperature derivatives of elastic wave velocities in plagioclase ($An_{51\pm 1}$) above and below the order-disorder transition temperature

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ABSTRACT

Compressional (v_p) and shear (v_s) wave velocities of plagioclase ($An_{51\pm 1}$) were measured up to 900 °C at 1 GPa. The temperature derivatives of v_p ($\partial v_p/\partial T$) and v_s ($\partial v_s/\partial T$) show a discontinuous change at ~400 °C. The $\partial v_p/\partial T$ is -0.9×10^{-4} km/s/°C below 400 °C and -4.4×10^{-4} km/s/°C above 400 °C. The $\partial v_p/\partial T$ also increases from -0.7×10^{-4} to -4.1×10^{-4} km/s/°C. These v_p and v_s show reversible changes between 25 and 700 °C. In contrast, both v_p and v_s increase (0.08 and 0.08 km/s, respectively) at 700–800 °C, and show irreversible changes after heating to 800 and 900 °C. The X-ray powder diffraction analysis shows that the run product heated to 900 °C shows a higher lattice angle γ than the run products obtained on heating up to 700 °C, which is comparable to the lattice angle γ of high and low plagioclase, respectively. We ascribe the discontinuous change in v_p , v_s , $\partial v_p/\partial T$, and $\partial v_s/\partial T$ to the order-disorder transition of plagioclase at high temperatures.

Keywords: Elastic wave velocity, plagioclase, phase transition, high temperature