T-P-V equation of state of NaCl based on simultaneous measurements of elastic wave velocities and density of NaCl

MATSUI, Masanori[1]*, Yoshihiro Okamoto[1], HIGO, Yuji[2], IRIFUNE, Tetsuo[3], Ken-ichi Funakoshi[2]

[1]Univ. Hyogo, [2]JASRI, [3]Ehime Univ.

The elastic compressional (P) and shear (S) wave velocities and densities of NaCl were simultaneously measured up to 12 GPa at 300 K, and up to 8 GPa at both 473 and 673 K, using a combination of ultrasonic interferometry, in situ synchrotron X-ray diffraction and radiographic techniques in a large-volume Kawai-type multi-anvil apparatus. We adopted experimental data after heating the sample to 873 K under fixed press loads, to minimize nonhydrostatic components due to local deviatoric stresses. At 300 K, both P and S wave velocities are found to change linearly with density up to 12 GPa, satisfying Birch's law. High-temperature and high-pressure equation of state (EOS) of NaCl was developed using the measured P and S wave velocities and densities based on the 300 K fourth-order Birch-Murnaghan finite strain equation combined with the Mie-Gruneisen relation and the Debye thermal model. Here we present a new temperature-pressure-volume EOS of NaCl, as a primary pressure standard, without relying on any pressure scale, at high temperatures and high pressures.

Keywords: high temperature and high pressure, elastic wave velocity, density, NaCl, equation of state