Elastic constants of single-crystal topaz studied via sphere-resonance method

*荒舘 佳子[1]、渡辺 了[1]、浜田 盛久[2]
*Kako Aradachi[1], Tohru Watanabe[1], Morihisa Hamada[2]

1. 富山大学、2. 海洋研究開発機構
1. University of Toyama, 2. JAMSTEC

Transport of ocean floor sediments by plate motions might play an important role in the circulation of materials within the Earth. Imaging subducted sediments through seismological observations requires a thorough understanding of elastic properties of sediment origin hydrous minerals. Topaz is a hydrous mineral, which can be formed from subducted sediment at high pressures. We have studied elastic constants of single-crystal topaz by the sphere-resonance method.

A sphere sample (D=2.665(1) mm) was made from a topaz single-crystal (Al1.97SiO4(F1.17,OH0.82)) collected from Ouro preto, Mines Gerais, Brazil by the two-pipe method. Lattice parameters are a=4.663, b=8.835, c=8.386 A (orthorhombic). Resonant frequencies were measured at frequencies from 1.6 MHz to 3.5 MHz with different specimen-holding forces. Extrapolating to the specimen-holding force of zero, we obtained frequencies of "free" oscillation. Elastic constants were determined by comparing measured and calculated resonant frequencies. The xyz algorithm (Visscher et al., 1991) was employed to calculate resonant frequencies of the sphere sample. At an ambient temperature, C11=281.2(5), C22=350.3(7), C33=288.4(5), C44=108.8(2), C55=130.9(2), C66=131.4(2), C12=121.3(2), C13=81.6(2), C23=82.1(2) (GPa).

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