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LETTERS

Elasticity of single-crystal calcite and rhodochrosite by Brillouin spectroscopy

CHIEN-CHIH CHEN,[1,*] CHUNG-CHERNG LIN,[1] LIN-GUN LIU,[1] STANISLAV V. SINOGEIKIN,[2] AND JAY D. BASS[2]

[1]Institute of Earth Sciences, Academia Sinica, Nankang, Taipei, Taiwan 115, ROC
[2]Department of Geology, University of Illinois, Urbana, Illinois 61801, U.S.A.

ABSTRACT

The single-crystal elastic moduli of natural samples of both calcite ($CaCO_3$) and rhodochrosite ($MnCO_3$) have been measured by Brillouin spectroscopy under ambient condition. Based on the trigonal unit cell, the elastic constants C_{11}, C_{33}, C_{44}, C_{12}, C_{13}, and C_{14} are 149.4(7), 85.2(18), 34.1(5), 57.9(11), 53.5(9), –20.0(2), and 223.9(15), 132.6(41), 44.5(9), 93.4(21), 76.0(23), –17.3(6) GPa for $CaCO_3$ and $MnCO_3$, respectively. Our data for calcite are in good agreement with earlier data obtained by ultrasonic experiments. The off-diagonal elastic constants (C_{12}, C_{13}, and C_{14}) for rhodochrosite have systematically larger values than the trend defined by other isostructural carbonates, in all of which the divalent cations are alkaline-earth metals. This is a distinctive signature of transition–metal-bearing oxides, which is present in silicates and simple oxides as well.