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Elastic Properties of Natural Biotite Crystals by Brillouin Spectroscopy

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Experiments were performed on natural crystals of biotite in an attempt to quantify the effects of impurities on acoustic phonon behaviour and elastic properties in this mica series. Electron probe microanalyzer(EPMA) was used to quantify the chemical compositions of biotite with differing concentrations of Fe and Mg. Brillouin light scattering spectra of these samples contained peaks due to pure transverse, quasi-transverse and quasi-longitudinal acoustic phonon modes. Analysis of these spectra permitted determination directional dependence of the velocities of these modes in the ac and bc crystallographic planes as well as the elastic constants C_{11}, C_{22}, C_{33}, C_{44}, C_{55}, C_{66}, C_{13}, C_{15}, C_{23}, C_{25}, C_{35}, and C_{46}. In general, the acoustic mode velocities decrease with increasing Fe concentration. The values of some elastic constants also appear to show a dependence on impurity and concentration.

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