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Equation of State of Stoichiometric Spinel to 10 kbar and 800°K. The elastic properties of a single crystal stoichiometric spinel have been measured at high pressure and high temperature simultaneously by use of an ultrasonic interferometric technique. Ultrasound was transmitted into the sample by wringing the sample to the end of a buffer rod. The mating surfaces were polished flat and smooth, and no bonding agent was needed between the buffer rod and sample. The elastic properties of the sample are compared with those of a non-stoichiometric spinel ($MgO \cdot 2.6\ Al_2O_3$) measured in the same laboratory by the same technique. The main difference is a value of C_{11} lower by ~ 5% for the stoichiometric sample. The differences in elastic properties will be discussed in terms of the structure of the samples.

T90
Richard J. O'Connell
Inst. of Geophysics & Planetary Physics, Univ. of Calif., Los Angeles, Calif.
Earl K. Graham
California Institute of Technology, Pasadena, California 91109

Pressure Dependence of Elastic Constants and Infrared Optical Frequencies of Spinel
A rigorous lattice dynamical calculation of the elastic constants and of all optical vibrational frequencies in the Brillouin zone center has been performed for spinel, $MgAl_2O_4$, as a function of pressure in the approximation of a modified rigid ion model. The model contains eleven parameters which describe general first nearest neighbor (Mg-O and Al-O) and central force second nearest neighbor (O-O) interactions. A set of parameters was obtained that reproduces the experimental elastic constants and infrared and Raman frequencies. On the basis of this model the experimental data of the first and second pressure derivatives of the elastic constants and the thermal Grueneisen parameter can be accounted for. A comparison of the results with those obtained from simplified theoretical treatments in which the long-range Coulomb forces and the internal strain contributions are neglected indicates the limitations and inconsistencies of these approximate calculations.

T91
Manfred E. Striefler
Gerhard R. Barsch
Materials Research Laboratory and Department of Physics, The Pennsylvania State University, University Park, Pa. 16802

The Pressure Dependence of the Elastic Coefficients of Orthopyroxene.
The nine adiabatic elastic coefficients of single crystal orthopyroxene have been measured at 25 degrees centigrade as a function of pressure to ten kilobars using an ultrasonic pulse superposition technique. The pressure dependence of the shear modes exhibit a small but noticeable nonlinearity. The orthopyroxene samples are natural gem quality specimens of the bronzite variety with the approximate formula $Mg_{.8}\ Fe_{.2}\ SiO_3$. Using the Voigt-Reuss-Hill approximation, the pressure derivatives for polycrystalline orthopyroxene are determined from the single crystal data. The single crystal and polycrystal results are compared to theoretical values for a hexagonal close-packed structure of oxygen anions and to experimental data of related earth-forming materials.

T92
Albert L. Frisillo
Dept. of Geology-Geophysics and the Materials Research Laboratory, The Pennsylvania State Univ., University Park, Pa.16802
G.R. Barsch
Dept. of Physics and the Materials Research Laboratory, The Pennsylvania State University, University Park, Pa. 16802

The Pressure Dependence of Lattice Thermal Conductivity of Enstatite Single Crystals. Lattice thermal conductivities parallel to [100] and [010] directions have been determined in the range from 19 to 56 Kb which includes a reversible polymorphic transition at about 38 Kb. The variations, in [cal $degr^{-1} cm^{-1} sec^{-1} Kb^{-1}$], of the conductivity coefficients with pressure at an average sample temperature of 65°C are:

$\Delta\lambda[100]/\Delta P = 1.8 \times 10^{-4}$, $\Delta\lambda[010]/\Delta P = 2.9 \times 10^{-5}$ below the transition and $\Delta\lambda[100]/\Delta P = 9.9 \times 10^{-5}$, $\Delta\lambda[0.10]/\Delta P = 2.8 \times 10^{-6}$ above the transition. These results combined with observations of the heat of transformation can be used to evaluate the relative stability of polymorphic phase transitions in enstatite samples in the presence of a temperature gradient at varying pressures.

T93
Z. Dvorak
H.H. Schloessin
Dept. of Geophysics, Univ. of Western Ont., London, Ont. CANADA.

The Electrical Conductivity of Olivine. Single crystals were measured as a function of temperature, composition and pressure to 7.5 kb. The variables of the equation $\sigma = \sum \sigma_x \exp(-A_x/kT)$ as determined at 5 kb are given in the table below. Mantle temperatures calculated from this data in conjunction with reported mantle conductivity models range from 700-1300°C at 40 km to 800-2800°C at 400 km. The variability of the pressure derivatives between olivines of almost the same composition indicates a need for a study of transport properties of the olivine system.

Composition	Temperature range studied	$\log \sigma_x$ (ohm cm)	$\left(\frac{d\log \sigma_x}{dP}\right)_T$	A_x (eV)	$\left(\frac{dA_x}{dP}\right)_T$
Fay 0	700-1100°C	-1.810	.444 kb^{-1}	1.426	.1104 $(kb)^{-1}$
Fay 0	1150-1250	21.972	----	8.018	-----
Fay 6	200-900	-1.675	.099	.807	.0172
Fay 11	200-900	-1.700	-.040	.692	-.0022
Fay 12	400-1100	-1.471	.247	1.076	.0442
Fay 12	1150-1250	20.056	----	7.140	-----
Fay 18	200-900	-0.320	.098	.700	.0201

T94
Al Duba
Dept. of the Geophysical Sciences, University of Chicago, Chicago, Ill. 60637

Equation of State of Olivine before and after the Olivine-Spinel Phase Change. Presented first in this paper are measurements of the elastic constants of olivine as a function of pressure, temperature, and Fe/Mg ratio. Next, with these data applied to theoretical models, parameters entering into equations of state for olivine before and after the olivine-spinel phase change are deduced. The results are as follows:

Composition	Phase	Density	V_p	V_s	Φ	K_s	dK_s/dp
100 Fo	Olivine	3.217	8.534	4.977	39.8	1.281	5.04
	Spinel*	3.556	9.66	5.54	52.4	1.86	4.4
50 Fo	Olivine	3.800	7.534	4.213	33.1	1.256	5.44
	Spinel*	4.209	8.85	4.92	46.4	1.93	4.8

T95
D.-H. Chung
Dept. of Earth & Planetary Sciences, Massachusetts Inst. of Technology, Cambridge, Mass.02139