TABLE VI. Acoustic and thermal data for crystalline Al, Cu, α-Fe, and MgO ($\sim$300°K).

Material	$-C_{I}$	$-C_{II}$	$-C_{III}$	α	$(\partial\alpha/\partial T)_p$	C_p	$(\partial C_p/\partial T)_p$
	($\times10^{-12}$ dyn/cm²)			($\times10^5$ deg⁻¹)	($\times10^8$ deg⁻²)	(J/g·deg)	($\times10^3$ J/g·deg⁻²)
Al(49Ll)	22.08	2.43	7.22	2.26[a]	1.03	0.903[e]	0.110
Al(59Sl)	19.48	7.51	7.55	2.26[a]	1.03	0.903[e]	0.110
Cu(49Ll)	27.04	13.60	9.05	1.67[b]	1.04	0.386[e]	0.099
Cu(58Dl)	31.09	18.00	14.14	1.67[b]	1.04	0.386[e]	0.099
Cu(66Hl)	28.99	16.78	15.63	1.67[b]	1.04	0.386[e]	0.099
α-Fe(66Rl)	44.18	21.96	19.17	1.17[c]	1.02	0.447[e]	0.418
MgO(65Bl)	50.61	4.60	12.11	1.05[d]	1.75	0.916[f]	1.80

[a] D. F. Gibbon, Phys. Rev. **112**, 136 (1958).
[b] D. Bijl and H. Pullan, Physica **21**, 285 (1955).
[c] F. C. Nix and D. MacNair, Phys. Rev. **60**, 597 (1941).
[d] J. G. Collins and G. K. White, *Progress in Low-Temperature Physics* C. J. Gorter, Ed. (North Holland Publishing Co., Amsterdam, 1964), p. 450.
[e] *Landolt-Börnstein Tables*, 6th ed. (Springer-Verlag, Berlin 1961), Vol. 2 (Pt. 4).
[f] T. H. K. Barron, W. T. Berg, and J. A. Morrison, Proc. Roy. Soc. (London) **A250**, 70 (1959).

Where $c_{\mu\nu\lambda}$ are the "mixed" third-order elastic constants in Voigt's notation. Once the values of $(\partial c_{\mu\nu}{}^s/\partial p)_T$ are found from these Eqs. (57) through (59), the calculations of polycrystalline acoustic data follow the procedure given in the previous sections.

6. DISCUSSION AND IMPLICATIONS OF THE PRESENT WORK

(a) The theoretical scheme of calculating the isotropic pressure derivatives of isotropic elastic moduli has been presented for cubic, hexagonal, trigonal, and tetragonal crystals. The scheme has been successfully tested for four cubic solids and also for one hexagonal metal of which both single-crystal and polycrystalline acoustic data are available. Although further testings of this scheme are needed, the writer believes that the validity of the present theoretical scheme is essentially established for cubic and hexagonal crystals; it is also believed that the scheme will probably apply for crystals of the lower symmetry.

For further testing of the validity of the scheme, the followings may be suggested: It would be of particular interest to test this scheme for highly anisotropic cubic crystals like RbI and Li as well as moderately anisotropic crystals like KCl and LiF, so that one may find to what extent the scheme is applicable for crystals of high elastic anisotropy. Also interesting work would be to test the scheme for rather incompressible solids like α-Al_2O_3 and TiC as well as for rather compressible materials like K and Na. The work of this kind would probably provide important information concerning the effects of grain boundaries on the polycrystalline acoustic data and on the compression behavior of aggregate solids like rocks.

(b) The thermodynamic relations are presented (in terms of the measured isothermal pressure derivatives of adiabatic elastic moduli) for the isothermal pressure derivatives of the isothermal elastic moduli, and also for the adiabatic pressure derivatives of the adiabatic elastic moduli. The acoustic data obtained from the usual ultrasonic-pressure experiments are the isothermal pressure derivatives of adiabatic elastic moduli; they are, for example, the practical quantities in the study of the propagation of seismic waves in the interior of the earth. The isothermal pressure derivatives of the isothermal elastic moduli are the quantities usually resulting from theoretical calculations according to the lattice theory of solids, and thus, they have important applications in testing of a theory with experimental values. In addition, these quantities have a direct application in the study of the compression in the earth interior. The adiabatic pressure derivatives of the adiabatic elastic moduli arise directly from the shock-wave experiments, and the calculated values corresponding to this thermodynamic boundary condition are useful in the study of the actual shock-wave propagation.

(c) In the following, two possible applications of the theoretical scheme are indicated: One is that the isotropic values dL^*/dp and dG^*/dp can be used in the calculation of the acoustic Grüneisen constant, in place

TABLE VII. Pressure derivatives of polycrystalline elastic moduli at different thermodynamic boundary conditions ($\sim$300°K).

Pressure derivatives	dK^*/dp	dG^*/dp	dL^*/dp
$(\partial M^s/\partial p)_T$	4.14[a] 4.12[b]	2.47[a]	7.43[a]
$(\partial M^T/\partial p)_T$	4.18 4.00($\pm$0.07)[c]	2.47	7.47
$(\partial M^s/\partial p)_s$	4.10	2.41	7.32

[a] Values taken from Table II.
[b] Value obtained from the Dugdale–MacDonald relation; i.e., $[(\partial K^s/\partial p)_T]_{p=0}=2\gamma_G+1$, where γ_G is the Grüneisen parameter.
[c] Value obtained from the Murnaghan equation of state using experimental compression data.