TABLE II. Comparison of predicted and experimental isotropic pressure derivatives of polycrystalline elastic moduli for Al, Cu, α-Fe, and MgO ($\sim$300°K).

	Material and reference[a]	Isothermal pressure derivatives of adiabatic moduli		
		$(\partial K^*/\partial p)_T$	$(\partial G^*/\partial p)_T$	$(\partial L^*/\partial p)_T$
Al	Calculated (49Ll)[a]	3.95	2.71	7.56
	Calculated (59Sl)	5.22	2.01	7.90
	Measured (61Vl)[b]	4.75	2.00	7.42
	Measured (66Bl)[c]	3.9	2.2	6.8
Cu	Calculated (49Ll)	4.44	0.86(?)	5.59(?)
	Calculated (58Dl)	5.59	1.36	7.40
	Calculated (66Hl)	5.28	1.45	7.21
	Measured (66 Bl)[c]	4.9	1.4	6.8
α-Fe	Calculated (66Rl)	5.96	1.91	8.50
	Measured (61Vl)[b]	5.13	2.16	8.01
	Measured (66Bl)[c]	4.0	1.9	6.5
MgO	Calculated (65Bl)	4.14	2.47	7.43
	Measured (66Bl)[c]	3.9	2.6	7.4

[a] See Table I for the complete reference.
[b] 61Vl: F. F. Voronov and L. F. Vereshchagin, Fiz. Metal Metalloved. 11, 443 (1961).
[c] 66Bl: F. Birch, *Handbook of Physical Constants*, S. P. Clark, Jr., Ed (Geological Society of America, 1966), Memoir 97, p. 124.

is

$$C_p - C_v = TV\beta^2 K^T = T\beta\gamma_G C_v. \tag{28}$$

It may be seen from Eqs. (25) and (28) that the two bulk moduli and the two specific heats have the same ratio:

$$K^s/K^T = C_p/C_v = 1 + TV\beta^2 K^s/C_p = 1 + T\beta\gamma_G = A. \tag{29}$$

Therefore,

$$K^T = K^s A^{-1}, \tag{30}$$

and this is a convenient relation to be used in the following.

Differentiating Eq. (30), with respect to pressure, yields

$$(\partial K^T/\partial p)_T = (\partial K^s/\partial p)_T + [(A-1)/A][1 - (2/\beta K^T)(\partial K^T/\partial T)_p - 2(\partial K^s/\partial p)_T] + [(A-1)/A]^2[(\partial K^s/\partial p)_T - (1/\beta^2)(\partial\beta/\partial T)_p - 1]. \tag{31}$$

The quantity $(\partial K^T/\partial T)_p$ can be obtained from the experimental $(\partial K^s/\partial T)_p$ by differentiating Eq. (30), with respect to temperature. Thus

$$(\partial K^T/\partial T)_p = (1/A)(\partial K^s/\partial T)_p - (K^T/A)(\partial A/\partial T)_p, \tag{32}$$

where

$$(\partial A/\partial T)_p = A[(A-1)/A]\{1/T + (1/\beta)(\partial\beta/\partial T)_p + (1/K^s)(\partial K^s/\partial T)_p + \beta[1 + (1/\beta^2)(\partial\beta/\partial T)_p] - (1/C_p)(\partial C_p/\partial T)_p\}. \tag{33}$$

Equation (31) is the desired relation from which one can calculate the isothermal pressure derivative of the isothermal bulk modulus from the experimentally measured $(\partial K^s/\partial p)_T$, the isothermal pressure derivative of the adiabatic bulk modulus. Equation (31) was given first by Overton.[10] Equation (32) is the relation through which one can convert the isothermal temperature derivative of the isothermal bulk modulus from the experimental $(\partial K^s/\partial T)_p$, the isothermal temperature derivative of the adiabatic bulk modulus.

It can be shown that, although Eqs. (25) and (26) are referred to the zero-pressure condition, these relations hold also for all the other pressures. Differentiating Eq. (25), with respect to pressure, yields

$$(\partial c_{11}^T/\partial p)_T - (\partial c_{11}^s/\partial p)_T = (\partial c_{12}^T/\partial p)_T - (\partial c_{12}^s/\partial p)_T = (\partial K^T/\partial p)_T - (\partial K^s/\partial p)_T = B, \tag{34}$$

where an expression for B may be found from Eq. (31):

$$B = [(A-1)/A][1 - (2/\beta K^T)(\partial K^T/\partial T)_p - 2(\partial K^s/\partial p)_T] + [(A-1)/A]^2[(\partial K^s/\partial p)_T - (1/\beta^2)(\partial\beta/\partial T)_p - 1]. \tag{35}$$

[10] W. C. Overton, Jr., J. Chem. Phys. 37, 116 (1962).