in which the fact that $d \ln k_j / d \ln V = -\frac{1}{3}$, $d \ln \varrho / d \ln V = -1$ has been used. The Slater gamma gives reasonably good agreement with Gruneisen's gamma at high temperatures, having in general a value larger than γ_G as shown in Table 1. Notable exceptions are silicon, germanium and the zinc blende structure materials where $\gamma_s \gg \gamma_G$.

GENERAL ACOUSTIC CONTINUUM GAMMAS

Recent acoustic measurements of all of the elastic constants of crystals as a function of pressure[3] permits one to relax several of the assumptions made above, namely the assumption of elastic isotropy and that of pressure independence of Poisson ratios. That is, referring again to Fig. 1, the slope of any dispersion curve in the continuum region which is the velocity of sound for waves of that mode type, is given by $v = \sqrt{\frac{C}{\varrho}}$ where C is the adiabatic elastic constant associated with the type of deformation involved in propagation of the wave. For example, the velocity of a longitudinal wave propagation along [100] of a cubic crystal is given by $(C_{11}/\varrho)^{\frac{1}{2}}$, that of a similarly propagating transverse wave is given by $(C_{44}/\varrho)^{\frac{1}{2}}$ and the mode gammas appropriate to each of these modes become:

$$\gamma_L\,[100] = -\frac{1}{2}\frac{d \ln C_{11}}{d \ln V} - \frac{1}{6},$$

$$\gamma_T\,[100] = -\frac{1}{2}\frac{d \ln C_{44}}{d \ln V} - \frac{1}{6}.$$

(The relation to the pressure derivatives is

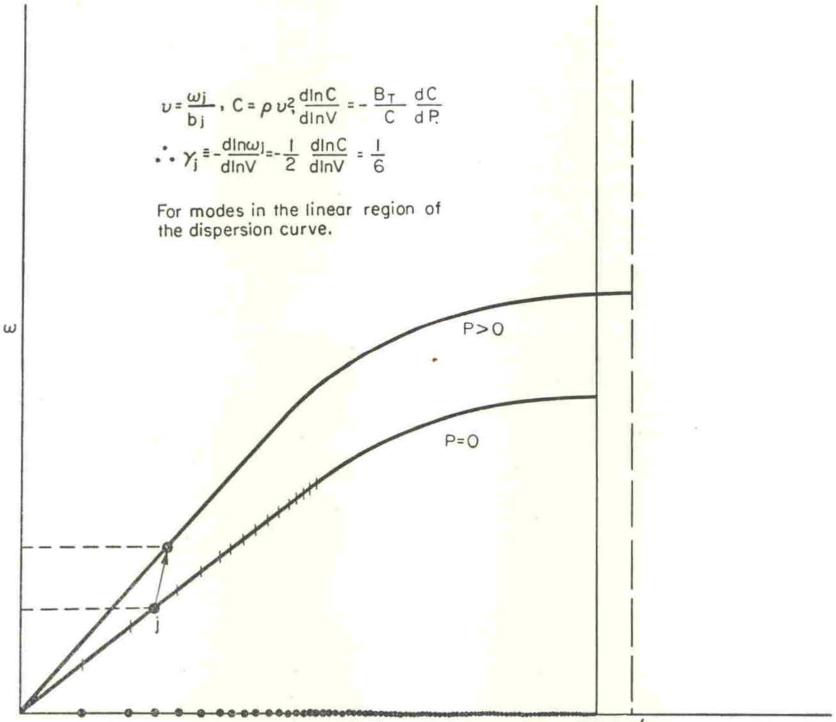

FIG. 1. Dispersion curve indicating the effect of pressure on a normal mode frequency.

Table 2. Values of mode gammas in symmetry directions of cubic crystals, together with their weighting factors v^{-3} for low temperatures. v^{-3} in units 10^{-18} (cm/sec)$^{-3}$

	Direction of propagation	γ_L	v_L^{-3}	$\gamma_{\tau 1}$	$v_{\tau 1}^{-3}$	$\gamma_{\tau 2}$	$v_{\tau 2}^{-3}$
	[100]	1·37	(1·64)	0·33	(5·01)	0·33	(5·01)
Si[a]	[110]	1·33	(1·30)	0·33	(5·01)	−0·12	(9·76)
	[111]	1·32	(1·21)	0·08	(7·47)	0·08	(7·47)
	[100]	1·29	(8·39)	0·584	(22·4)	0·584	(22·4)
Ge[b]	[110]	1·28	(6·33)	0·584	(22·4)	0·170	(48·1)
	[111]	1·27	(5·78)	0·360	(35·9)	0·36	(35·9)
	[100]	1·51	(47·7)	1·06	(111)	1·06	(111)
Na[c]	[110]	1·36	(26·2)	1·06	(111)	1·06	(2138)
	[111]	1·34	(22·5)	1·06	(400)	1·06	(400)
	[100]	2·48	(13·4)	1·92	(41·4)	1·92	(41·4)
Cu[d]	[110]	2·30	(8·8)	1·92	(41·4)	1·49	(243)
	[111]	2·19	(7·8)	1·76	(105)	1·76	(105)
	[100]	2·71	(25)	2·38	(108)	2·38	(108)
Ag[d]	[110]	2·69	(17·7)	2·38	(108)	1·96	(569)
	[111]	2·68	(16·0)	2·21	(263)	2·21	(263)
	[100]	2·86	(31·9)	3·38	(312)	3·38	(312)
Au[d]	[110]	3·00	(26·1)	3·38	(312)	2·31	(1500)
	[111]	3·03	(24·6)	2·94	(731)	2·94	(731)
	[100]	2·28	(3·97)	2·80	(29·3)	2·80	(29·3)
Al[e]	[110]	2·43	(8·61)	2·80	(29·3)	2·36	(39·5)
	[111]	2·43	(3·63)	2·53	(35·6)	2·53	(35·6)
	[100]	2·64	(9·81)	0·14	(72·2)	0·14	(72·2)
NaCl[f]	[110]	1·87	(11·55)	0·14	(72·2)	2·72	(43·8)
	[111]	1·57	(12·26)	2·04	(50·9)	2·04	(50·9)
	optic	1·20		3·61		3·61	
	[100]	2·18	(11·33)	−0·74	(184)	−0·74	(184)
KCl[f]	[110]	1·42	(17·9)	−0·74	(184)	2·42	(41·9)
	[111]	1·04	(21·6)	1·92	(59·5)	1·92	(59·5)
	optic	0·74		2·61		2·61	
	[100]	2·53	(54·3)	−1·06	(1447)	−1·06	(1447)
RbI[g]	[110]	1·91	(98·4)	−1·06	(1447)	2·56	(186)
	[111]	1·54	(128)	2·15	(273)	2·15	(273)

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