Table 1. *Summary of shock wave compression data on* [111] *germanium* $\rho = 5{\cdot}35$ g/cm^3

Shot	u_p(a) (mm/μsec)	No. of waves	U_1 (mm/μsec)	U_2(b) (mm/μsec)	U_3(b) (mm/μsec)	σ_1 (kb)	σ_2(c) (kb)	σ_3(d) (kb)	$(V/V_0)_1$	$(V/V_0)_2$(e)	$(V/V_0)_3$(f)
58	0·0775	1	5·63	—	—	23·3	—	—	0·9864	—	—
59	0·1286	1	5·78	—	—	39·8	—	—	0·9778	—	—
148	0·1580	2	5·63–5·78	3·43	—	c	46·5	—	e	0·9705	—
147	0·1620	2	5·79	3·41	—	c	49·0	—	e	0·9697	—
135	0·1700	2	5·75	3·58	—	c	50·3	—	e	0·9675	—
133	0·2132	2	5·75	3·54	—	c	58·3	—	e	0·9551	—
60	0·3432	2	—	3·63	—	c	83·5	—	e	0·9193	—
149	0·5540	2	5·79	4·13	—	c	136	—	e	0·8748	—
150	0·6015	3	—	4·26	1·17	c	d	142	e	f	0·8413

(a) Particle velocity is taken as ½ the measured impact velocity.
(b) Wave velocity relative to laboratory coordinates.
(c) Stress of the second wave is computed assuming the particle velocity of the first wave is 0·1443 mm/μsec.
(d) Stress of the third wave is computed assuming the particle velocity of the second wave is 0·5778 mm/μsec.
(e) Volume computation assumes particle velocity of first wave is 0·1443 mm/μsec.
(f) Volume computation assumes particle velocity of second wave is 0·5778 mm/μsec.

between multiple waves is unknown for a single experiment; however, if in a series of experiments the total particle velocity is systematically varied in the immediate neighborhood of a suspected cusp in the stress–volume relation until a change in the number of waves is observed, the particle velocity associated with each of the multiple waves is established. The stresses and volumes associated with any multiple wave structure can then be calculated from conservation of mass and momentum relationships,(9) if it is assumed that the particle velocity associated with a cusp is independent of driving pressure.

SECTION 2
SHOCK COMPRESSION RESULTS

Two cusps in the stress–volume relation are revealed in the data summary shown in Table 1. For a particle velocity, u_p, less than 0·1286 mm/μsec a single wave is observed and at u_p = 0·1580 mm/μsec two waves are observed. Thus, a cusp exists between these two values of particle velocity. From u_p = 0·1580 mm/μsec to 0·5540 mm/μsec two waves are observed, while at u_p = 0·6015 mm/μsec three waves are observed.

The first of the two cusps observed and investigated is at a stress of 44 ± 4 kb which corresponds to the transition between elastic and plastic behavior, and the second is at a stress of about 140 kb which we will show is the solid–solid phase transition observed by MINOMURA and DRICKAMER(10) at a pressure of about 120 kb. Before considering the properties of the transition the shock wave compression at lower stresses must be examined.

Hugoniot elastic limit

The leading wave is identified as an elastic wave by comparison of the wave velocity with the low signal wave velocity(12) of 5·54 mm/sec. The wave velocity is somewhat higher than the low signal velocity, but this is to be expected on the basis of the finite compressions in the shock experiment. There is no detectable volume change (< 0·5%) associated with the cusp at 44 kb; thus this cusp is clearly not identifiable as a first order phase transition.

The particle velocity of the elastic wave as obtained by other investigators is shown in Table 2. There is a wide variance in values obtained by

Table 2. *Various values for the particle velocity of the elastic wave of* [111] Ge

WACKERLE(11)	MCQUEEN(13)
0·153 mm μsec^{-1}	0·114 mm μsec^{-1}
0·161 mm μsec^{-1}	0·134 mm μsec^{-1}
0·168 mm μsec^{-1}	
0·178 mm μsec^{-1}	