Table 5

Experimental pressure derivatives extrapolated to zero temperature compared to calculated pressure derivatives, dimensionless

	dC_{44}/dP	dC'/dP	dB/dP	core radius	reference
(calc)	1.7	0.25	3.5	1.36	[30]
(calc)	1.0	0.09	3.2	0.92	[30]
(exp)	0.93	0.05	3.3		present paper

Table 6

Pressure derivatives of the shear elastic constants C_{44} and C' from Jain [27] and present work; dimensionless, $T = 300$ °K

dC_{44}/dP	dC'/dP	reference
1.03	0.081	[27]
1.08	0.08	present paper

Table 7

Values of B_0^T and $(dB_0^T/dP)_T$ at 300 °K

B_0^T (kbar)	$(dB_0^T/dP)_T$	method
110	—	ultrasonic [18]
116	—	ultrasonic [19]
115	3.56 ± 0.1	ultrasonic (present)
112	3.60 ± 0.3	volumetric [41]
109	3.5	shock [42]

coefficients to the lowest temperatures measured. What is more, at any pressure within the range of the present experiments, the temperature coefficients of all of the elastic constants remain negative.

The present data also indicates that the microscopic instability concept does not apply to the martensitic transformation in lithium. The data shows that at all temperature–pressure points within the region (85 to 300 °K, 1 bar to 3.5 kbar) all of the elastic constants have negative temperature and positive pressure derivatives. It is conceivable that although dC'/dP is positive at 3.5 kbar it becomes negative at higher pressure, so that C' does in fact become negative at a finite pressure such as one that might be present in a dislocation core. It is possible that the microscopic instability is not evident at low pressures. If C' were to go to zero at 22 kbar as the microscopic instability theory suggests, then dC'/dP at 3.5 kbar should already be -0.14 kbar. At temperatures within 20 °K of the transformation, the quantity dC'/dP could not be continuously monitored, thus a small negative change, if it did exist, could well be masked by the absolute value measurement errors. Detection then would require accurate measurement of the second derivative, d^2C'/dP^2, to considerably higher pressures than the 3.5 kbar of the present experiments. Even under the best of conditions the measurement of d^2C'/dP^2 is a difficult task.

6. Conclusions

1. The present results, evaluated at $T = 300$ °K and atmospheric pressure, are not in sharp disagreement with previous elastic constant data published by Nash and Smith [18] and Slotwinski and Trivisonno [19].

2. The present elastic constant temperature derivatives fall between those of Nash and Smith and of Slotwinski and Trivisonno.

3. The pressure derivatives of C_{44} and C' are in excellent agreement with those published by Jain [27] at 300 °K.

4. When account is taken of the non-sphericity of the Fermi surface of lithium, the calculated zero-temperature elastic constants are in error by only a few percent when compared to the three sets of extrapolated experimental values.

5. The present data on lithium indicate that the elastic constants above the martensitic transformation temperature do not show evidence of the impending transformation. There is as yet no evidence that either the bulk elastic instability concept proposed by Zener or the microscopic elastic instability put forward here apply to the martensitic transformation in lithium.

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