

Figure 4. Temperature variation of the linear thermal expansion coefficient α of single-crystal CdTe measured along the $\langle 100 \rangle$ axis (O). The polycrystalline results of Browder and Ballard (Δ) and Novikova (+) are shown for comparison.

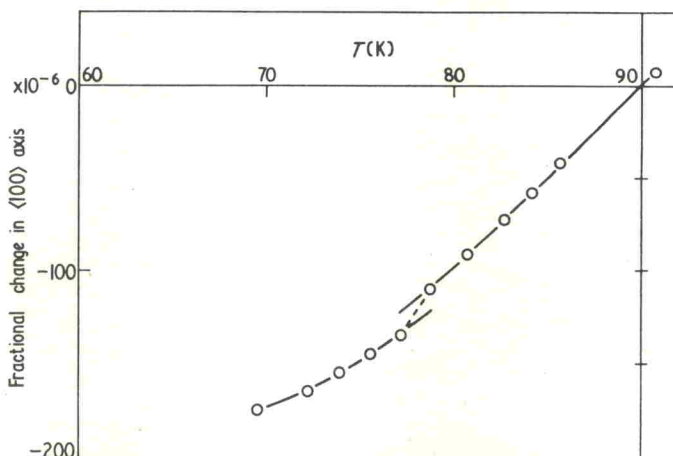


Figure 5. Fractional change in lattice parameter, in a $\langle 100 \rangle$ direction, relative to 90 K.

4. Conclusions

There is no evidence that any of the II-VI compounds show an anomaly in either the elastic constants or thermal expansion similar to that described here. The absence of any

anomaly in previous work on CdTe may, however, be easily explained. The elastic constant work of Vekilov and Rusakov (1971) was only taken down to 77 K, and results were reported at 20 K intervals. The thermal expansion work of Novikova was carried out on polycrystalline samples, which would tend to average out any anomaly if it was anisotropic in character. Browder and Ballard only reported work down to 70 K, with results taken at 10 K intervals. The specific heat data of Rusakov *et al* (1971), again on polycrystalline material, do not exhibit any anomalous behaviour. If one assumes that the effect on the elastic constants is only due to the lattice distortion, and assuming that the elastic constants vary as r^{-4} , where r is the interatomic distance (Huntingdon 1958), the change of about 1 part in 10^5 in the lattice parameter should produce a change of about 4 parts in 10^5 in the elastic constants. This would not be detectable with the present experimental arrangement.

It has been suggested by Berlincourt *et al* (1963) and Vekilov and Rusakov (1971) that the structure and elastic properties of II-VI compounds with the cubic sphalerite and hexagonal wurtzite structures are sensitive to the degree of ionic bonding. A decrease in temperature will cause a variation in the width of the forbidden energy gap in the valence electron gas and consequently change the degree of ionic bonding. One can only tentatively assume that the anomalous behaviour observed could be due to an abrupt change in ionicity.

More accurate measurements of the elastic constants using either the phase comparison or ring-around technique would be useful together with an x-ray investigation of the lattice parameters near 80 K. Detailed specific heat measurements on single-crystal samples and measurements of the dielectric constant d_{14} or the piezoelectric constant e_{14} would also be of interest. The change in ionicity could be directly monitored by resistivity measurements close to 80 K.

The elastic constants have been extrapolated to 0 K and used to calculate the Debye temperature θ_D of CdTe. The approximation due to Anderson (1963) was used and a value of 162.7 K obtained. This is in agreement with the value of 161 ± 4 K calculated from elastic constant measurements extrapolated from 77 K (Vekilov and Rusakov 1971) and 164 ± 5 K from specific heat measurements (Rusakov *et al* 1971).

Acknowledgments

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