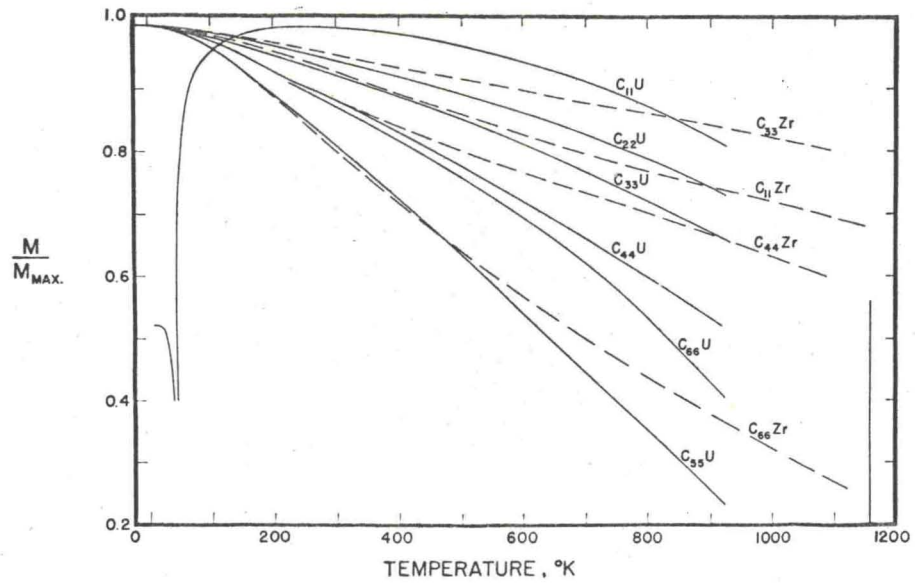

Fig. 5. Comparison of the temperature dependence of the principal stiffness moduli for alpha uranium and alpha zirconium [10]. Ordinate is the ratio of the modulus at temperature with respect to the maximum value of the modulus.

for c_{66} are -623 ppm/°K and -2300 ppm/°K respectively.

A comparison of the fractional change in the stiffness moduli with temperature is given in fig. 5, where the moduli are plotted as normalized to the respective maximum values. Included in the figure are the curves of the normalized moduli of zirconium [10]. Between 50° and 500° K the fractional change with temperature for c_{55} follows the c_{66} curve for zirconium very closely. The c_{66} zirconium curve, however, has a pronounced upward curvature, whereas c_{55} continues to decrease linearly with temperature to about 23 % of its maximum value. Similarly, c_{44} uranium follows the c_{44} zirconium curve very closely below 320° K but the differences increase at higher temperatures because of curvatures with opposite signs.

The c_{33} modulus for uranium undergoes the greatest decrease of the three principal compressional moduli. The total decrease in c_{33} from 50° K to 923° K is 34 %, compared to 27 % for c_{22} uranium and c_{11} zirconium. The c_{11} uranium decrease from the maximum value at 250° K is only 19 %.

The curves obtained from the c_{12}, c_{13} and c_{23} moduli, given in table 3, are shown in fig. 6. The c_{13} values give a relatively smooth curve, with a broad minimum between 175° and 275° K. The c_{12} values indicate a relatively sharp change in slope in the range of 725° K. In contrast to c_{12} and c_{13}, c_{23} decreases with increasing temperature.

3.4. Parameters computed from compliance moduli

Several informative aspects of this study appear in the temperature dependence of various combinations of the compliance moduli, which are computed from the inverse matrix of the stiffness moduli. The linear compressibilities,

$$\begin{aligned}\beta_{100} &= s_{11} + s_{12} + s_{13}\\ \beta_{010} &= s_{22} + s_{12} + s_{23}\\ \beta_{001} &= s_{33} + s_{13} + s_{23}\end{aligned} \qquad (2)$$

and the volume compressibility,

$$\beta_V = \beta_{100} + \beta_{010} + \beta_{001}$$

at various temperatures are given in table 4 and plotted in fig. 6. Upon heating from the phase transition at 41° K, β_{100} and β_{010} become