ference bands at intersections of the horizontal slip traces in two mutually perpendicular faces of the sample [12]. It should be noted that the direction of shear in basal slip in the case of our orientation is $[2\bar{1}\bar{1}0]$, in contrast to the usually observed direction $[11\bar{2}0]$ in beryllium single crystals oriented at $\alpha = 45°$.

We shall consider possible mechanisms for the appearance of basal slip in beryllium single crystals when tangential stresses in the basal plane (0001) are zero because of the selected orientation of the crystals relative to the compressive forces.

Since the stresses generated on deformation of the crystals are considerable, elastic bending of the lattice is possible and consequently tangential stresses may appear in the basal plane (0001) which in turn gives rise to shear deformation. An estimate of the magnitude of the elastic bending of the lattice sufficient for the appearance of tangential stresses greater than the critical shearing stresses ‡ and producing basal slip, gives values of the bending angle less than 1°.

This is not the only possible way in which shear can appear in the basal plane of beryllium single crystals of the given orientation. We shall assume that dislocations moving in a pyramidal plane and causing shear in that plane are pinned at some obstacle; a stress concentration is produced around this obstacle. The compressive force at the obstacle will then be oriented at some angle to the basal plane [the angle between the planes (0001) and $(11\bar{2}4)$ amounts to 38°06']. Such orientation of the compressive forces with respect to the (0001) plane and the stress concentration in this plane may consequently give rise to tangential stresses which will cause shear. It should be noted that, in our case, shear in the basal plane destroys the continuity of the crystal. Fracture on shear in the basal plane (0001) occurs along the planes of the second-order prism $\{11\bar{2}0\}$ and the second-order pyramid $\{11\bar{2}4\}$, and, moreover, the (0001) layers are bent, forming cracks in the basal plane ** (Fig. 8).

A considerable divergence should be noted between the present results and those of foreign workers [6, 7]. As mentioned above, the compressive strength of beryllium single crystals along the hexagonal axis has, according to Lee and Brick [6], a weak temperature dependence in the range 20-500°C. Moreover, the maximum fracture stresses of beryllium single crystals at 500°C are higher than at 300°C.

In the present paper we have shown that the compressive strength decreases monotonically with increasing temperature in the range 4.2-900°K. The compressive strength σ_b decreases almost by a factor of 3 between 300 and 900°K, while Lee and Brick reported that the compressive strength changed by about 20% in the same range. This difference between the reported temperature dependences of the compressive strength can be explained by the different purities of the materials. The weak variation of the compressive strength with increase of temperature is related to strong hardening caused by dispersion ageing in the process of high-temperature plastic deformation of the less pure beryllium.

Conclusions

1. Beryllium single crystals of 99.9% purity oriented and stressed in such a way as to avoid the possibility of plastic deformation in the principal crystallographic planes exhibit exceptionally high compressive strengths, especially at low temperatures.

2. At high temperatures (500-900°K) beryllium single crystals of the given orientation exhibit plasticity in the form of slip, mainly along the second-order pyramidal planes $\{11\bar{2}4\}$ along the direction $[11\bar{2}3]$. Pyramidal slip in beryllium single crystals has a high critical shear stress.

3. Basal slip is also observed, and it may be the result of either elastic bending of the lattice due to high critical stresses of the pyramidal shear, or the result of stress concentration at obstacles impeding the motion of dislocations in pyramidal planes.

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‡The calculation was carried out on the assumption that the law of critical tangential stresses is valid.

**We may also assume that slip along the planes $\{11\bar{2}4\}$ is the result of penetration of a tetrahedron with the bounding planes (0001), $(1\bar{2}14)$, $(\bar{2}114)$ and $(11\bar{2}4)$ along the hexagonal axis c. The penetration of such a wedge obviously produced a longitudinal bending of the (0001) layers by forces acting from within along the direction $(11\bar{2}0)$.