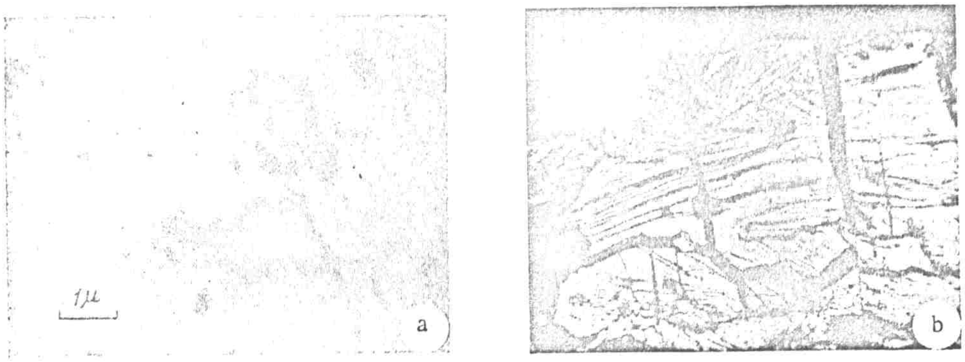

Fig. 5. Photomicrographs of particles obtained on fracture of beryllium single crystals. a) $T = 4.2°K$, $\sigma_b = 532\ kg/mm^2$, $\bar{d} = 1.0\text{-}2.0\ \mu$; b) $T = 300°K$, $\sigma_b = 210\ kg/mm^2$, $\bar{d} = 100\ \mu$. (× 200).

These experiments confirm once again the unfavorable influence of plastic deformation on the strength of materials. As in the case of whiskers, macroscopic single crystals are very strong under conditions ensuring large elastic deformation before fracture.

In single crystals of the given orientation the elastic deformation is spread throughout the crystal, and compression throughout the crystal is more uniform. The only possible mechanism for the observed small residual change of the crystal shape is the process of block formation which occurs at very high stresses immediately before fracture. This is indicated by the fracture of the whole crystal into particles of one to several microns in dimensions.

Although the compressive strength falls considerably at high temperatures (500-900°K), the value of σ_b nevertheless remains much higher than the compressive strength of beryllium single crystals of other orientations. It is interesting that at these high temperatures beryllium single crystals have a high yield point corresponding to deformation by slip along pyramidal planes.

B. Pyramidal and Basal Slip in Beryllium Single Crystals at High Temperatures

The characteristic feature of the deformation of beryllium single crystals of the given orientation in the temperature range 500-900°K is the instantaneous localized shear along second-order pyramidal planes on fracture, in contrast to the fragmentation into small particles at low temperatures. Figure 6 shows a photo-

TABLE 1. Plasticity and Strength Parameters of Beryllium Single Crystals on Compression along the Hexagonal Axis

	h, mm	f_0, mm^2	T, °K	σ_b, kg/mm^2	σ_b, kg/mm^2	δ_e, %	δ_p, %	δ_{tot}, %	$E \cdot 10^4$, kg/mm^2
Be-2 . . .	2.18	1.72	4.2	532	—	1.1	0.6	—	4.745
Be-5 . . .	2.11	1.65	77	410	—	0.9	0.9	—	4.55
Be-7 . . .	2.06	1.73	300	210	—	0.6	1.0	—	3.5
Be-11 . . .	4.56	7.42	500	124	112	0.4	4.3	27.3	3.1
Be-14 . . .	4.05	5.8	700	90	68.9	0.3	7.5	38.5	3.01
Be-18 . . .	4.05	5.16	900	72	50.4	0.3	9.2	45.0	2.39

TABLE 2. Principal Elements of Plasticity as a Function of Orientation

Orientation	T, °K	σ, kg/mm^2	σ, kg/mm^2	Nature of plastic deformation
P⊥(0001)	77	410	–	Elastic compression; slip along (0001) and $\{10\bar{1}0\}$ and twinning along $(10\bar{1}2)$ avoided by orientation
	300	210	–	
P < 45° (0001)	77	34	3.4	Slip along basal plane (0001)
	300	18	2.16	
P‖(0001)	77	103	5.3	Slip along $\{10\bar{1}0\}$ planes, twinning along $\{10\bar{1}2\}$; slip along (0001) avoided by orientation
	300	64	3.7	