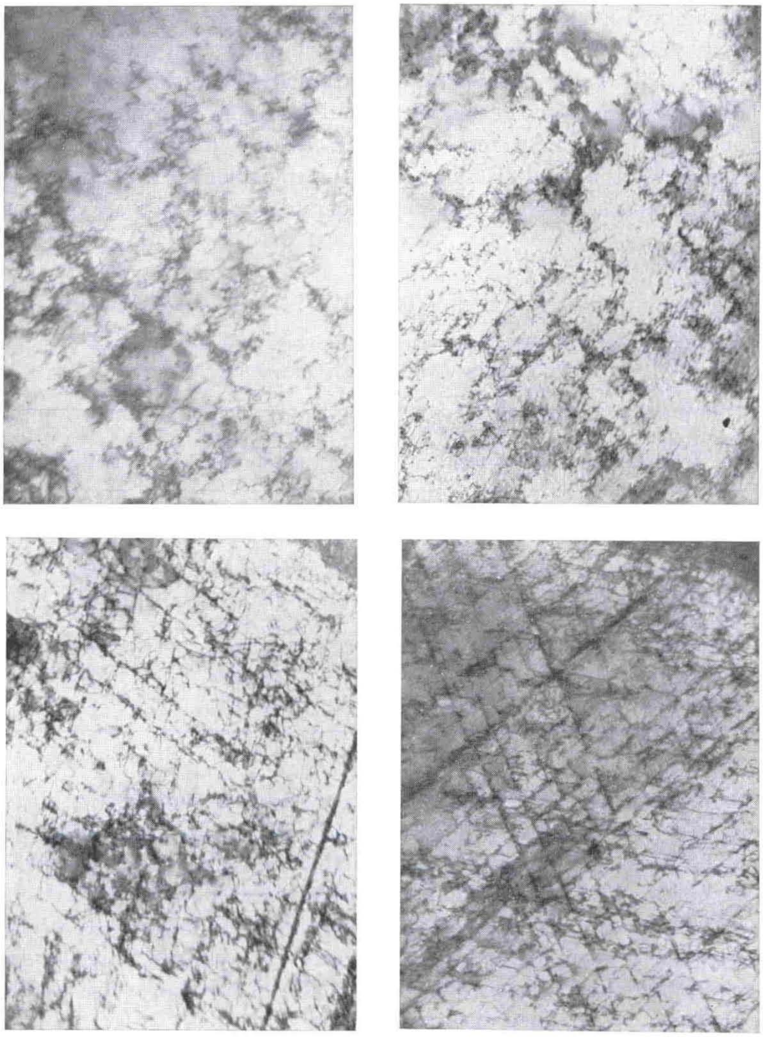

FIG. 3. Dislocation configurations in α brasses produced by shock deformation. Magnification 26,000 × (reduced 50 %). (*a*) Cu–6 wt. % Zn after 55 kilobars. (*b*) Cu–10 wt. % Zn after 55 kilobars. (*c*) Cu–20 wt. % Zn after 55 kilobars. (*d*) Cu–30 wt. % Zn after 50 kilobars.

Table I, despite the fact that the deformation resulted from transient stress waves.

A summary of observed dislocation structures, including the results of the present study as well as those of previous investigators, is presented in Table III. Again, one can observe that, even in the case of shock loading, nickel, copper, and alloys of high SFE yield cell structures, whereas those of lower SFE exhibit coplanar-type structures. According to this summary, the transition SFE for shock-deformed materials lies somewhere in a range between 25 and 36 ergs/cm^2. This result represents a substantial reduction in the previously determined limits of 25 to 80 ergs/cm^2 as reported by Grace *et al.*[23] A comparison of the data presented in Tables I and III shows that the transition SFE is essentially the same in f.c.c. metals deformed either by moderate shock or by more conventional means.

TABLE III

DISLOCATION CONFIGURATIONS PRODUCED IN F.C.C. METALS BY EXPLOSIVE-SHOCK DEFORMATION

Metal	SFE (ergs/cm^2)	Dislocation configurations	Reference
Ni	200	Cells	19
Cu	80	Cells	Fig. 2
Cu–6 wt. % Zn	50	Cells	Fig. 3*a*
Cu–10 wt. % Zn	36	Cells	Fig. 3*b*
304 stainless steel	25	Coplanar	22
Cu–20 wt. % Zn	18	Coplanar	Fig. 3*c*
Cu–30 wt. % Zn	14	Coplanar	Fig. 3*d*
Silicone bronze	2.4	Coplanar	21

It is of interest that the SFE controls the development of dislocation structures to about the same extent as in the case of shock deformation; particularly in view of the vast differences in the deformation parameters. As an example of these differences, nominal stresses at 50 kilobars shock pressure are an order of magnitude greater than those encountered during conventional testing. Furthermore, recent measurements by Barker[27] indicate that a stress wave of 50 kilobars has an associated strain rate of about 10^7 in./in.-sec. Read[28] has shown that the separation distance of an extended dislocation can be written as

$$d = \frac{G\,|\,\tilde{b}\,|^2}{8\pi\gamma}\left[\frac{2 - \nu(1 + 2\cos 2\alpha)}{1 - \nu}\right] \tag{3}$$

where γ is the SFE, G is the shear modulus, ν is Poisson's ratio, $\tilde{b}$ is the Burger's vector, and α indicates the character of the dislocation ribbon ($\alpha = 0°$ for a screw and $\alpha = 90°$ for an edge). Under hydrostatic compression, we would expect variations in G, $|\,\tilde{b}\,|$, ν, and possibly γ and d. Variations in ν, based on pressure derivatives of elastic moduli,[29] give the result that the bracketed term in equation 3 does not vary appreciably with pressure to 100 kilobars. For copper