Howie and Swann[3] also showed that in general the solute atoms in forming alloys lower the SFE. Henceforth, a number of investigators studied the effect of the SFE over a range of values on the dislocation structures produced by deformation. Swann[7] and Howie[10] reported a transition from cell structures to coplanar dislocation arrangements as a function of SFE in a series of copper-aluminum alloys having a compositional range between 2 and 8 wt.% aluminum. Mader[9] investigated single crystals of nickel-cobalt alloys having a compositional range up to 60 wt.% cobalt. A cell structure was observed in all these alloys at the end of stage II deformation. These results suggested that alloying could be responsible for variations in substructure providing it lowers the SFE below some critical value or range of values henceforth denoted as the transition SFE. Thomas[11] investigated a series of brasses of varying composition in the α phase, having a wide range of SFE, and observed varying dislocation arrangements. Coplanar dislocation configurations were observed in the low-SFE stainless-steel alloy by Whelan.[2] The results of the many previous investigations cited here clearly support the widely accepted view that the SFE influences the dislocation configurations formed in f.c.c. metals and alloys. For comparison purposes a summary of these results is presented in Table I. Where applicable the quoted values of SFE reflect a correction factor of approximately 2, as indicated by the analysis of Brown.[14] The data of the table would indicate that

TABLE I

SUMMARY OF OBSERVED DISLOCATION CONFIGURATIONS IN CONVENTIONALLY DEFORMED F.C.C. METALS AND ALLOYS

Metal	SFE[a] (ergs/cm^2)	Dislocation configurations[b]	References
Al	220–350	Cells	*a:* 6, 12, 13; *b:* 7
Ni	200	Cells	*a:* 3*, 9; *b:* 9
Ni–40 % Co	130	Cells	*a, b:* 9, 15
Cu	80	Cells	*a:* 3*; *b:* 7
Au	60	Cells	*a:* 5, 12; *b:* 7
Cu–8 wt. % Zn	38	Cells	*a:* 3*, 11*; *b:* 11
Cu–2 wt. % Al	37	Cells	*a:* 3*; *b:* 10
Ni–60 % Co	32	Cells	*a:* 9, 15, 16; *b:* 9
304 stainless steel	25	Coplanar	*a, b:* 2*
Cu–16 wt. % Zn	23	Cells	*a:* 3*, 11*; *b:* 11
Ag	22	Cells	*a:* 17, 18; *b:* 8
Cu–24 wt.% Zn	16	Coplanar	*a:* 3*, 11*; *b:* 11
Cu–4.5 wt. % Al	7	Coplanar	*a:* 3*; *b:* 10
Cu–8 wt. % Al	4	Coplanar	*a:* 3*; *b:* 7

* These data corrected according to Brown.[14]

the transition SFE lies somewhere between about 16 and 32 ergs/cm^2 for metals subjected to quasistatic deformation. The reader is referred to the references for further details.

At present there are indications that the stacking fault energy may also be important when unconventional means of deformation are encountered, as in the case of shock loading. Nolder and Thomas[19] and Johari and Thomas[20] observed cell structures in nickel and copper after low shock pressure, while Otte and Holland[21] and Inman *et al.*[22] observed layered-type structures in silicon bronze and 304 stainless steel, respectively. Grace *et al.*[23] contrasted previous results with their observations of shock-deformed Cu—30 wt.% Zn alloy. These studies showed that below 100 kilobars shock deformation pressure the transition SFE occurs between about 25 and 80 ergs/cm^2. The present investigation was undertaken to study the variation of shock-induced dislocation structures with SFE more thoroughly and, if possible, to determine the transition SFE more precisely through use of a series of copper-zinc alloys of the α phase.

Experimental Procedure

The specimens consisted of high-purity polycrystalline copper and α brasses having the f.c.c. structure. These were obtained in sheet form (0.127-mm thickness) with compositions as indicated in Table II. Two-hour heat-treatments with

TABLE II

SPECIMEN COMPOSITION

Metal	Cu (wt. %)	Impurities (wt. %)	Balance
Cu	99.999	0.001	—
Cu–6 wt. % Zn	93.64	< 0.01	Zn
Cu–10 wt. % Zn	89.36	< 0.01	Zn
Cu–20 wt. % Zn	79.82	< 0.01	Zn
Cu–30 wt. % Zn	69.59	< 0.02	Zn

furnace cooling were given to the specimens to remove prior cold work. The brasses were annealed at 650°C in pure argon, whereas the copper was annealed at 450°C in vacuum. The final grain size of all specimens was approximately 0.12 mm. The specimens were deformed at only moderate levels of shock pressure which would correspond approximately to the beginning of stage III in simple tension. This was done to produce dislocations of sufficient density so as to be readily characterized while avoiding heavily worked substructures and mechanical twinning.

Several specimens of each material (2.5 cm square) were shock-loaded in an