

have $\delta \approx 0$. In terms of microscopy, the α plates are single plates, since as δ approaches zero from its maximum value, the habit planes for a twin related pair diverge.

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From Figure 1, two different types of habit planes were observed at 90 kb. Five habits were approximately $(\bar{1}\bar{1}2)_\gamma$, and only one was near the $(\bar{2}\bar{2}5)_\gamma$. At 150 kb., for the variant of the orientation relationship used, the habit plane was always found to be near to $(\bar{1}\bar{1}2)_\gamma$.

The position of the habit plane depends on the choice of inhomogeneous shear system and the values of the lattice parameters. The inhomogeneous shear system whose habit plane is the $(\bar{1}\bar{1}2)_\gamma$ has been found to be the $(111)_\gamma[\bar{1}\bar{2}\bar{1}]_\gamma$, while the shear system of the habit plane $(\bar{2}\bar{2}5)_\gamma$ is the $(110)_\gamma[1\bar{1}0]_\gamma$. The set of traces analyzed failed to define a specific habit plane. This scatter may be due to the poorly resolved γ plates. A real variation due to varying lattice parameters however, cannot be ruled out. In determining the dilation parameter δ , we note that the $(111)_\gamma[\bar{1}\bar{2}\bar{1}]_\gamma$ traces tended to be closer to zero dilation which is necessary for a transformation induced by a compressive shock front.

The shear system of the $(\bar{1}\bar{1}2)_\gamma$ habit involves a shear on the $(101)_\alpha$ which is 80° from the habit plane of zero dilation. The γ plates observed at 90 kb were internally twinned on the $\{111\}_\gamma$. The $\{111\}_\gamma$ twinning plane was always found to be at an angle of $80-90^\circ$ to the habit plane. We conclude that the internal twins are not deformation twins but are a result of the inhomogeneous shear in the α' to γ transformation. The internal twins further indicate that the transformation occurred through a shear system of the type $(111)_\gamma[\bar{1}\bar{2}\bar{1}]_\gamma$.

The untransformed α -martensite showed the typical structure of cold worked metals. On transforming, no preferential nucleation sites were observed. Since γ bands were found with deformation twins, it is believed that there is some relationship between the nucleation of twins and γ plates.

In the Fe-14 Mn alloy, single α' plates as opposed to a twin related pair were observed in specimens shock loaded at 90 and 150 kb. These single plates may be due to the $\alpha \rightarrow \epsilon \rightarrow \alpha'$ transformation. In explaining these observations one must consider the orientation relationships between γ , ϵ and α . The orientation relationship is (9,10)

$$\begin{array}{ccc} (111)_\gamma & || (0001)_\epsilon & || (101)_\alpha \\ [110]_\gamma & || [1210]_\epsilon & || [111]_\alpha \end{array}$$

with the standard viriant of the KS relationship. The convention of BCC α to HCP ϵ requires an invariant plane strain on $\{112\}_\alpha$ together with a dilation (δ) of about 1.5%. The dilation is in the form of a small uniform expansion (11). However, under a compressive shock wave, the dilation is not energetically favorable, and any transformation that does take place must