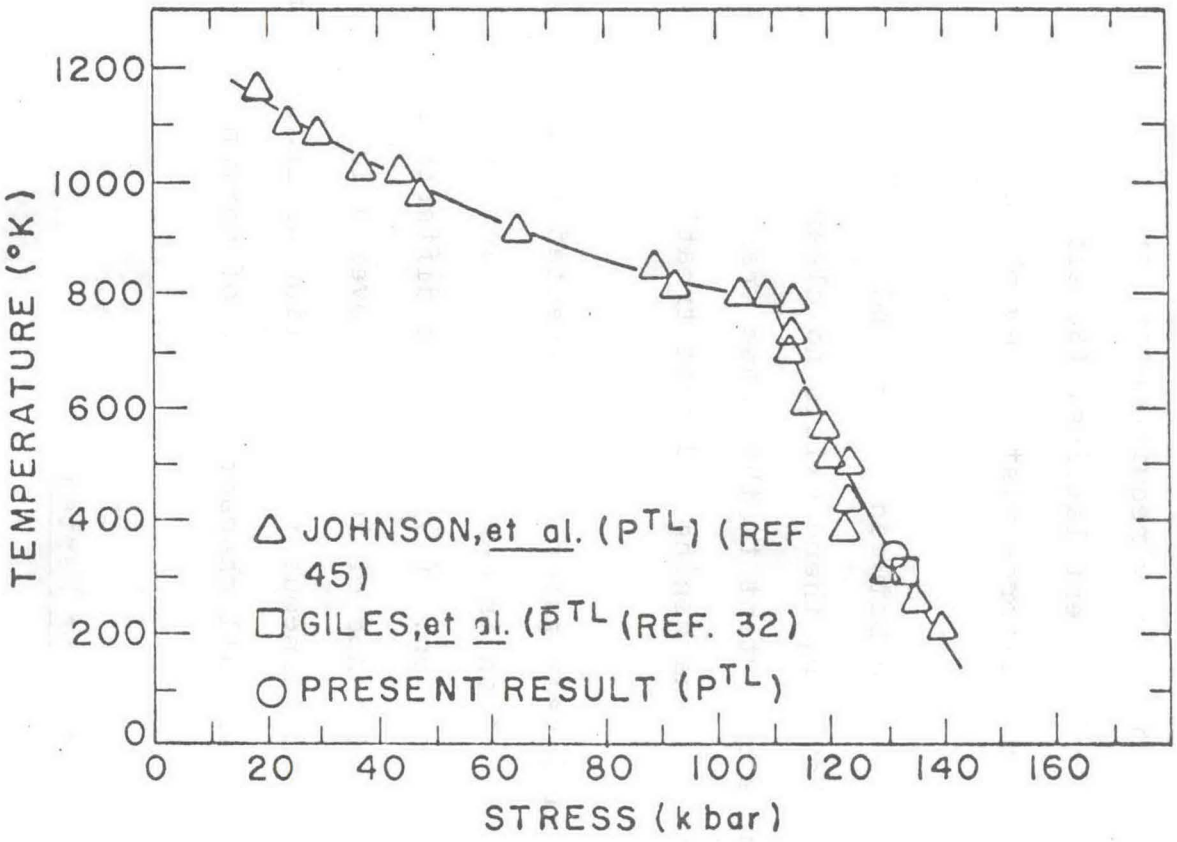

Fig. 5.1.--Transformation stress for iron under compression at various temperatures.

5.1.3. Discussion

Differences between the measured Hugoniot and calculated equilibrium Hugoniot may result from several causes including: (1) partial transformation, (2) transformation to a metastable state, (3) surface energy requirements for the new phase to nucleate, (4) strain energy requirements for accommodation of the new phase in the parent lattice, (5) effects of shear on the transformation, and (6) pre-existing new phase nuclei of various sizes.

The difference between P^{Teq} and $\overline{P}^{Teq}$ is presumably due to shear. However, there exists no clear evidence that shear in iron is important to the phase transformation, except for effects of work hardening and heat treating prior to shock loading.[22]

Several investigators have suggested that the alpha to epsilon transformation is martensitic. Giles, et al.[32] make the strongest case based on: (1) the large difference between $\overline{P}^{TL}$ and $\overline{P}^{TU}$, (2) existence of two phases over a large pressure range, and (3) simultaneous transformation of independent areas. These properties are all characteristic of martensitic transformations.

5.2. Characteristics of Martensitic Transformation

Martensitic transformations are defined in terms of process, not in terms of structure or properties. They require no diffusion of atoms; they are displacive or shearlike, in that the atoms move cooperatively to produce substantial shape changes