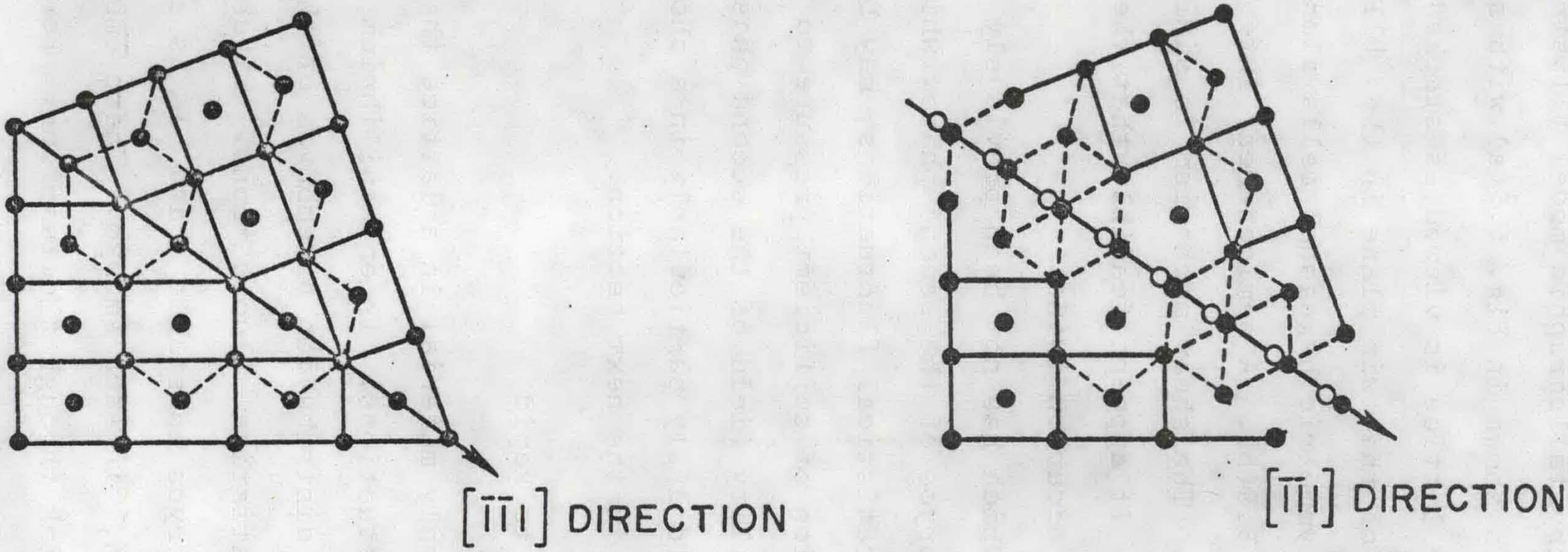
plane of the twin. A crystallographic model illustrating a twinned bcc lattice is shown in Fig. 5.5(a) with some irregular hexagons outlined. The lattice is viewed as stacked (110) planes. A small shear of the twin plane in the [111] direction results in a layer of symmetric hexagonal cells along the twin plane as shown in Fig. 5.5(b). A semicoherent interface exists between the two phases. The shear mechanism is similar to the one given in Fig. 5.3. It appears feasible that the nucleation of the hcp phase can occur on twins.

A possibility which has not been previously investigated is that equilibrium embryos of the second phase, which always exist as a result of statistical fluctuations, may be "frozen-in" by sudden application of sufficient pressure to bring the material into the stability field of the second phase. This type of nucleation would apply particularly in a shock wave. It is described in detail in the next section.

5.3.2. Nucleation Due to Rapid Application of Stress

Consider here only material in a lattice that is perfect except for thermal fluctuations. In an equilibrium state of the first phase there is a distribution of embryos of the second phase due to normal statistical fluctuations. Figure 5.6(a) shows the number of embryos in stable phase 1 as a function of the number of atoms, n, in each embryo. These embryos are created, grow, and shrink through fluctuations. For this case, where phase 1 is stable, energy to grow increases monotonically as shown by curve A in Fig. 5.6(b) where $G_{21} > 0$. If



(a) CROSS SECTION OF A TWIN IN BCC IRON AS VIEWED ON THE (110) PLANE

(b) SMALL SHEAR IN THE $[\bar{1}\bar{1}1]$ DIRECTION IN (112) TWIN PLANE RESULTS IN HEXAGONAL SYMMETRY ALONG TWIN PLANE

Fig. 5.5.--Shear mechanism in body-centered-cubic iron to obtain hexagonal symmetry along a twin plane.