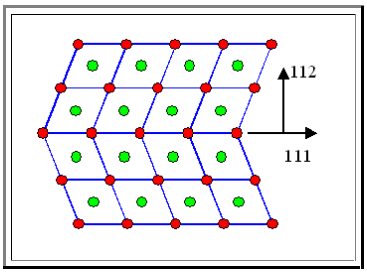
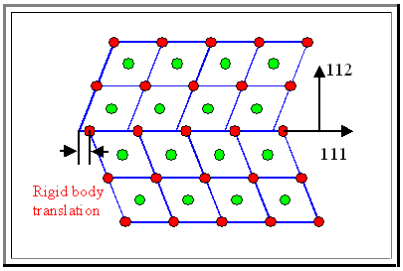
Rigid Body Translations

Advanced

- This is a somewhat special point; it only serves to illustrate that grain boundaries are complicated defects indeed.
  - Lets look at at twin boundary in a **bcc** crystal. The **bcc** geometry favors **{112}** planes for twins; a **<110>** projection of what you would expect would look like this:



  - However, what you get (according to calculations based directly on interatomic forces by **Vitek** in **1970** and subsequent **TEM** investigations) is something like this:



- There is some *rigid body translation* shifting one crystal with respect to the other one in the plane of the boundary.
  - The effect is due to the detailed nature of the interatomic potentials, but seems to be rather common. What will it do for structural considerations? Two things:
  - **1.** Besides the **5** parameters describing the geometry of the boundary that we encountered so far, we now need *three more*: The two components of the rigid body translation vector ***R*** in the plane of the boundary, and the (generally possible) third component perpendicular to this plane.
  - **2.** If there is some symmetry for ***R***, i.e there are several equivalent possible directions for the component in the boundary plane, different parts of the boundary may have rigid body translations along different directions. Wherever they meet, we need a *new kind of one-dimensional defect:* The boundary line between areas with different ***R***'s.
- OK - you get the drift: There seems to be some potential for complications - and mother nature certainly is aware of this!