03/15/2021

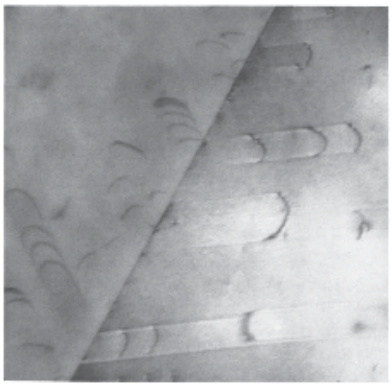
HW13: Curved Dislocations

Show that the radius of curvature, R, of the dislocation segments (as appears in the transmission electron micrograph shown below) is related to the applied shear stress, σ_S, by the following equation

$$\sigma_S = \frac{Gb}{2R}$$

where b is the slip vector of the dislocation.

Please explain all the steps in your derivation exactly.



The micrograph on the left (from a transmission electron microscope) represents the plan view of a slip plane with segments of cross-slipped dislocations bowing out from a force being applied to them.

We begin by considering one such segment lying in a slip plane and consider an applied shear stress that forces it to bow out in a circular fashion.

The circle of the segment has a radius of curvature. The dislocation has a slip vector, and the segment has two pinning points. The spacing between these two pinning points is the third geometrical property of this problem.