

Series 10 Solutions

6 December 2024

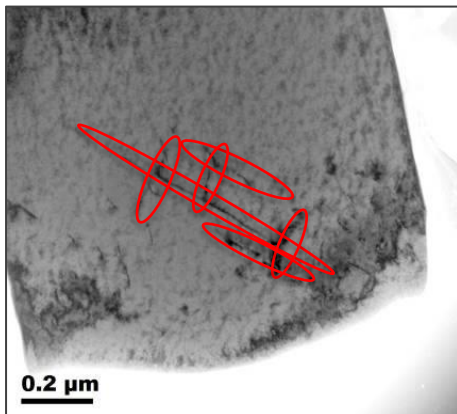
Exercise 1 Dislocation Analysis

a)

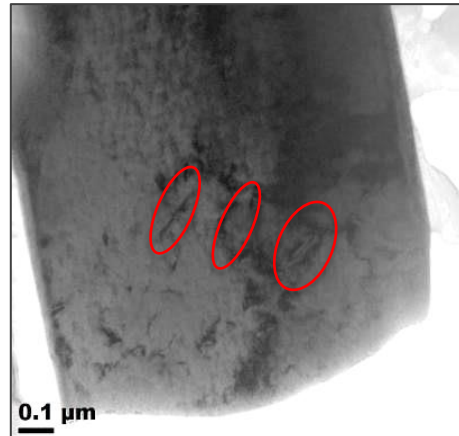
Diffraction contrast is a form of amplitude contrast arising from the electron beam scattering in the sample at defined Bragg angles. A strong 2-beam condition is set up by tilting a sample such that a diffraction condition on a specific g-vector and the Ewald's sphere cuts through the reflection rod at $s=0$. Under these conditions, the intensity is strongly any distortion of the atomic planes of the excited g-vectors. These areas appear bright in dark-field images and dark in bright-field images.

b)

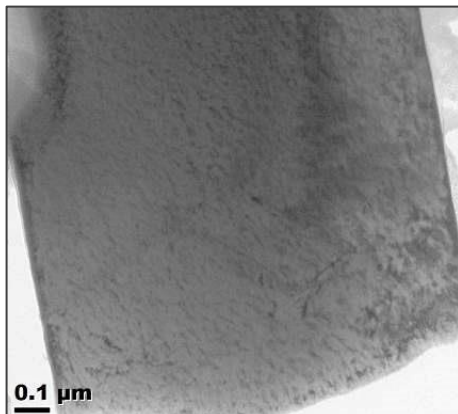
I indicated some dislocations by circling them in the images in red. Please note in the lower left image all dislocations are invisible.



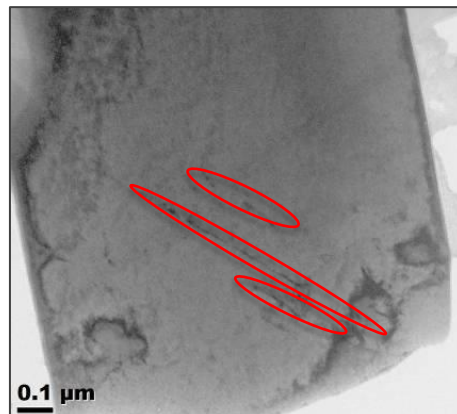
$g_1 = [1\ 0\ 3^-]$



$g_2 = [1\ 2\ 3]$



$g_3 = [1\ 1\ 2]$

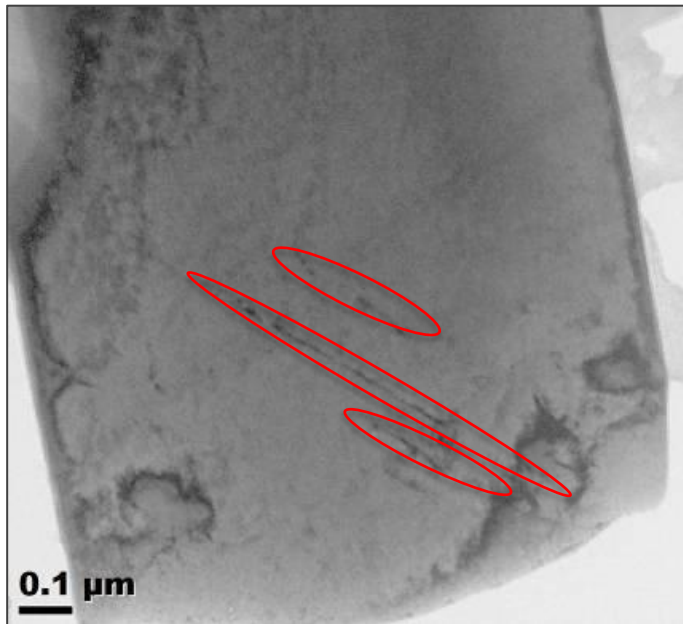


$g_4 = [1\ 2\ 3^-]$

c)

Since the curvature of atomic planes arises from the local elastic strain field of a dislocation with a given burger's vector, contrast is governed by the amplitude diffracted signal along a g -vector. The invisibility criteria, i.e., no contrast in conditions where $g \cdot b = 0$ for screw dislocations and $g \cdot b = 0$ $g \cdot b \wedge \vec{\xi} = 0$ for edge dislocations.

d) Identify this possible Burgers vector, assuming that this is a screw dislocation which has a Burgers vector of type: $b = a_0/2 \langle 1\ 1\ 1 \rangle$



$g_4 = [1\ 2\ \bar{3}]$