

3.091 Fall Term 2009

Homework Quiz #8A

solution outline

Calculate the acceleration potential that will result in electron diffraction from the (111) plane of nickel (Ni) at an angle, θ , of 44.4° . The lattice constant of nickel, a , has a value of 3.53 \AA .

$$\lambda_e = 2d_{(111)} \sin \theta = 2 \times \frac{a}{(h^2 + k^2 + l^2)^{1/2}} \sin \theta$$
$$= 2 \times \frac{3.53}{\sqrt{3}} \sin 44.4^\circ = 2.85 \text{ \AA}$$

$$eV = \frac{1}{2} m v^2 \quad \therefore v = \sqrt{2eV/m}$$

$$\lambda_e = \frac{h}{m v} = \frac{h}{(2meV)^{1/2}}$$

$$\therefore V = \frac{h^2}{2\lambda^2 m e}$$
$$= \frac{(6.6 \times 10^{-34})^2}{2 \times (2.85 \times 10^{-10})^2 \times 9.11 \times 10^{-31} \times 1.6 \times 10^{-19}}$$
$$= \underline{\underline{18.4 \text{ V}}}$$