Answer on Question #51565, Physics, Solid State Physics

A crystal has a cubic unit cell of 4.2 Å. Using a wavelength of 1.54 Å at what angle (2) would you expect to measure the (111) peak?

Solution

d-spacing equation for cubic is given by Eq.(1)

$$d = a/\sqrt{h^2+k^2+l^2} = a/\sqrt{1^2+1^2+1^2} = a/\sqrt{3} \quad (1)$$

According Bragg`s law

$$2d\sin\theta = m\lambda \quad (2)$$

So, for

$$\theta = \arcsin\left(\frac{\lambda}{2d}\right) = \arcsin\left(\frac{\lambda\sqrt{3}}{2a}\right) = \arcsin\left(\frac{1.54\sqrt{3}}{2\cdot 4.2}\right) \approx 18^0 \quad (3)$$

Answer: $\theta \approx 18^0$