

Question:

A thermal neutron with a speed v corresponding to the average thermal energy at temperature $T=300\text{K}$ is incident on a crystal. Will a diffraction pattern be obtained? Explain.

Solution:

As far as the momentum of the neutron $p^2 = 3mkT$, and de Broglie wavelength $\lambda = \frac{h}{p} = \frac{h}{\sqrt{3mkT}}$,

subject to the Bragg condition $2d \sin \theta = n\lambda$, we have $\sin \theta = \frac{nh}{2d\sqrt{3mkT}} = \frac{n \cdot 6.63 \cdot 10^{-9}}{d \cdot 2\sqrt{2074}} = n \cdot 0.24$

(assuming that interplanar spacing $d = 3 \cdot 10^{-10}$ m) what means that diffraction pattern will be obtained.

The answer:

A diffraction pattern will be obtained.

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