

Answer on Question #46453-Physics-Electromagnetism

The saturation magnetization of fcc Ni is $m_{Sat} = 5.1 \cdot 10^5 \frac{A}{m}$. If the lattice constant for Ni is $3.52 \text{ \AA}$, calculate the net magnetic moment per Ni atom in the crystal in units of Bohr magnetons.

Solution

Lattice constant is $a = 3.52 \text{ \AA}$; atomic density is $\rho_A(Ni) = \frac{4}{0.352^3} \frac{atoms}{nm^3} = 91.7 \frac{atoms}{nm^3}$.

If we look at a Bohr magneton, m_{Bohr} , we have

$$m_{Bohr} = 9.27 \cdot 10^{-24} \text{ Am}^2.$$

The net magnetic moment per Ni atom in the crystal is

$$m_A(Ni) = \frac{m_{Sat}(Ni)}{\rho_A(Ni)} = \frac{5.1 \cdot 10^5 \frac{A}{m}}{91.7 \frac{atoms}{nm^3}} = \frac{5.1 \cdot 10^5 A \cdot 10^{-27} m^2}{91.7} = 5.56 \cdot 10^{-24} \text{ Am}^2 = 0.600 m_{Bohr}.$$

Answer: 0.600 m_{Bohr} .