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Exercises "Electronic Materials"

#7

Exercise 7: Ferromagnetism

The molar volume of iron is $V_M = 7.1\ cm^3$.
a) Calculate the atomic density of Fe.
b) Determine the maximum achievable magnetization M_{max} under the assumption that each Fe-atom in the crystal contributes μ_{Bohr}.
c) What is the magnetic polarization J in this case?

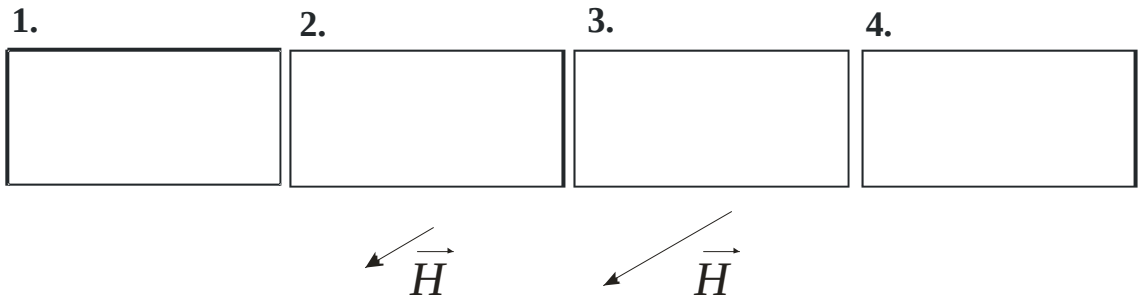

Fig. 1: A rectangular piece of iron is exposed to variable magnetic fields $\vec{H}$ (see text).

d) Draw the internal domain structure of a piece of iron into **Fig. 1** (Assume that the easy directions are perpendicular to each other):

1.) before any magnetization.
2.) for a small external magnetic field $\vec{H} << \vec{H}_{Sat}$ (saturation field).
3.) for an external magnetic field $\vec{H} >> \vec{H}_{Sat}$.
4.) after the magnetic field is switched off.

e) Give a short justification for your configuration chosen in 1).
f) Draw the magnetization curve $M(H)$ for this case and mark the positions of the four domain configurations in that curve.
g) How can a structure similar to the initial domain structure be retained again?
h) Can diamagnetism occur in a ferromagnetic material?