

Magnification and Metallography

Name:

Date:

Group

Members:

Questions:

(2) What do we mean when we say our specimen is a homogeneous specimen?

(2) For a fixed proportion of each phase in a two phase specimen (ex. 25% yellow, 75% green) how does the *number* of individual particles of the minority phase (the one with the smaller amount) vary with particle size? (e.g. more particles means...what?)

(2) For a fixed proportion of each phase in a two phase specimen, how does the phase boundary area vary with the *size* of the minority phase particles (e.g. smaller particles means...what?)

(2) For a fixed proportion of each phase in a two phase specimen, how does the phase boundary area vary with the *shape* of the minority phase particles? (e.g. irregular particles means...what?)

(3) What is the diameter of an average human hair? (Tell how you determined this, what magnification, etc.)

(3) To the right is an optical micrograph of a piece of polished and etched molybdenum. If the picture is magnified 400X, construct and label a scale (micron) bar 2 cm long to show the scale of the picture? Why might an ASTM grain size not adequately describe the size of the grains in this material?



James F. Shackelford , *Introduction to Materials Science for Engineers 2nd Ed.*, Macmillan, New York, 1988, p. 191

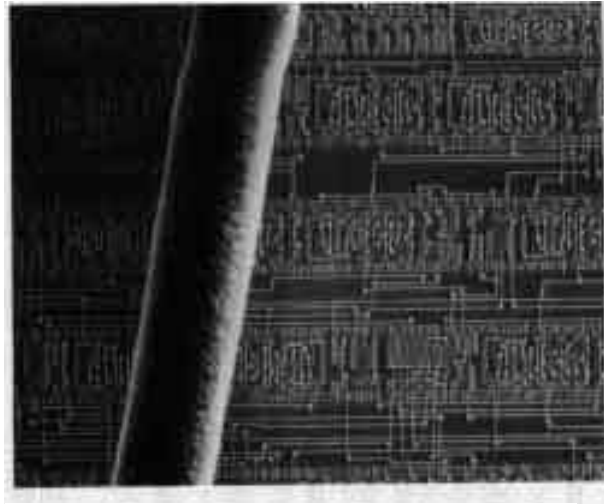
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(3) Calibrating microscope magnification can be done by comparing the size of a known object to the size of the object in the image produced by the microscope. The tobacco mosaic virus is sometimes used for checking the calibration of transmission electron microscopes (TEM's). Given the head (top part of micrograph) of the virus is 65 nanometers (65×10^{-9} m) across, what magnification is the micrograph to the left?

N. A. Campbell , *Biology Second Edition* , Benjamin/ Cummings, 1990, p 351.

(3) To increase the number of devices on each chip, semiconductor manufacturers reduce the size of each component. The smaller devices make the manufacturing processes much more sensitive to contamination. If a human hair was to get into the manufacturing process, what is the *minimum* number of devices (use the width of a hair) that would be ruined assuming a feature size of $0.25 \mu\text{m}$ (0.25×10^{-6} m) and a single layer of devices? The micrograph to the right was taken with a scanning electron microscope (SEM). Line widths in the micrograph are greater than $0.25 \mu\text{m}$. (Don't use the micrograph for calculations.)



L.H. Van Vlack , *Elements of Materials Science and Engineering*, Sixth Edition , Addison-Wesley Publishing Co., 1990. p.437.