UC DAVIS Chemical Engineering & Materials Science

# EMS-162L: Structure and Characterization of Materials Laboratory

**Winter Quarter, 2004**

# Introduction to the Optical Microscope

## The Basics

1. What are typical wavelengths of visible blue, red and green light?

2. What are the typical resolution limits for optical microscopy, electron microscopy and for the unaided eye? What is the typical maximum magnification for each?

3. Define intensity as it applies to the light used in optical microscopy.

4. What are the roles of contrast and resolution in the images you see in the microscope?

## Construction

**The Illumination System**

5. Starting at the source and ending at the specimen, what are the major optical components in the illumination system?

6. Describe how to adjust the aperture diaphragm for correct illumination.

7. Correct illumination is essential to good microscopy. When you are adjusting the various components in the illumination system, what exactly are you trying to achieve in terms of how the incident light hits the specimen?

**Objective Lense System**

8. Examine the objective lenses on your microscope and fill in the following table.

| Objective Lens | Type | Numerical Aperture | Immersion Medium | Tube Length (mm) | Cover Slip Thickness (mm) |
|---|---|---|---|---|---|
| 5X | | | | | |
| 10X | | | | | |
| 20X | | | | | |
| 40X | | | | | |
| 100X | | | | | |

## Operation

9. Describe step-by-step how to place a specimen on the stage and how to obtain properly focused images using the 20X objective. Assume the illumination system has been properly adjusted.

10. Describe step-by-step how to use the dark-field illumination feature of your microscope.

11. Describe step-by-step how to adjust the eye pieces.

## Performance

12. Let's assume you are using a 550 nm light source and the optics described in question 8. Fill in the following table.

| Objective Lens | Magnification at the Eye Piece | Angle of Acceptance | Resolution (microns) | Depth of Field (microns) |
|---|---|---|---|---|
| 5X | | | | |
| 10X | | | | |
| 20X | | | | |
| 40X | | | | |
| 100X | | | | |