

Mineralogy

Uniaxial Crystals

Uniaxial crystals belong to either the hexagonal or tetragonal crystal systems. Uniaxial crystals always have parallel extinction, and may be optically positive or negative depending on which index of refraction (n_r) is greater. The purpose of this lab is to acquaint you with interference figures in uniaxial crystals, but note that *information obtained from interference figures should be used to **verify** mineral identification; it is a final test rather than a starting place.*

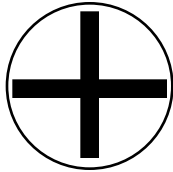
Answer the following questions. Use either thin section 1957, 1966, 1956, 3108, or 3309 for questions 1a, 1b, 1c.

1. Quartz may be unequivocally distinguished from any feldspar in that quartz is a uniaxial mineral whereas all feldspars are biaxial.
 - (a) Find a grain of quartz that will yield a **centered optic-axis figure**. Determine the optical sign of quartz and draw a picture of the interference figure (with the gypsum plate inserted).
 - (b) Find a grain of quartz that will yield an **off-centered optic-axis figure**. Draw the interference figure obtained (with gypsum plate inserted) for every 90° rotation.
 - (c) Find a grain of quartz that will yield a **flash figure**. Draw the flash figure at extinction and a few degrees from extinction.
 - (d) Quartz grains that have been deformed due to shearing can give unusual interference figures. Sample BA-1, -2, etc. contains strained quartz showing undulatory extinction. Find a centered optic axis figure on a strained quartz grain. Draw the interference figure at extinction and away from extinction.
2. Another important uniaxial mineral is calcite. Using grain mount 44-4159, list the optical features and make a sketch of an optic axis interference figure of calcite. Thin sections 3292 & 3293 are igneous rocks composed primarily of calcite. Generally, calcite is a secondary mineral in igneous rocks; however, in these rocks, calcite crystallized from an igneous melt. Briefly examine and describe one of the two thin sections.
3. Common accessory minerals in igneous rocks include apatite (grain mounts: M27, M40) and zircon (M33, M49). Examine both minerals. List their optical properties. Draw pictures of their interference figures (with gypsum plate inserted). What is the optical sign of each? Section 3898 is a rock containing apatite, among other minerals. Examine this thin section, find and describe the apatite.

Uniaxial Interference Figures

A. Centered Optic-axis Figure

A grain that will give a centered optic axis figure is a grain having the c-axis perpendicular to the microscope stage. Only the w refractive index is seen in this circular section. **The grain remains extinguished under cross-nicols during rotation.**

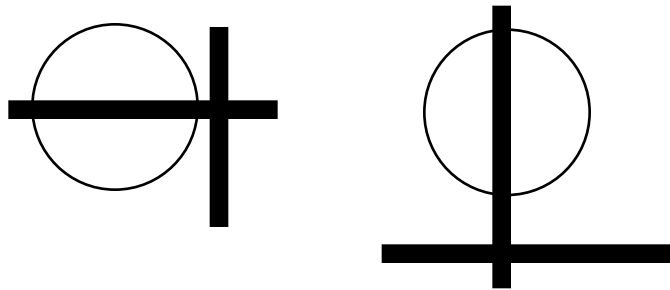


Centered Optic Axis

B. Off-Centered Optic-axis Figure

Any random section will yield this type of figure. The optic axis is oblique to the plane of the stage. Grains will have moderate interference colors or retardation.

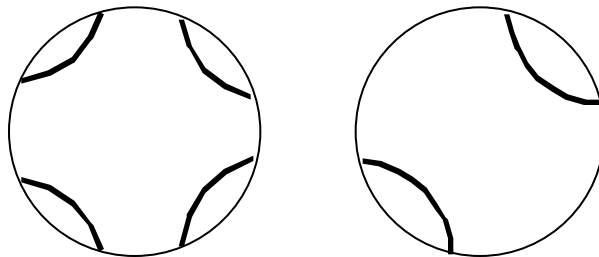
Off-Centered Optic Axis



C. Flash Figure

Grains oriented such that the optic axis is parallel to the plane of the stage will yield a flash figure. These grains show the highest retardation. A flash figure is a broad diffuse cross that nearly fills the field of view. On rotating the stage 3 to 4°, the cross breaks up and leaves the field of view.

Flash Figure



4 or 5° rotation