Chapter 2: Refractometry

SARAH LAMBART

Properties of light

- Electromagnetic wave
- Velocity depends on the media.
- Maximum velocity: under vacuum ~ 3 * 10⁸ m/s

Isotropic versus anisotropic minerals

Interaction of light with matter:

- Refraction: index of refraction n and Snell's law
- ► Reflection
- ► Dispersion
- ► Absorption
- ▶ Polarization: 2 perpendicular polarizers \Rightarrow extinguished light

Interaction of light with matter:

- Refraction: index of refraction n and Snell's law:
 - $n_1(sin i) = n_2 sin(r)$
- ► Reflection
- Dispersion
- ► Absorption

▶ Polarization: 2 perpendicular polarizers \Rightarrow extinguished light

Interaction of light with matter:

- Refraction: index of refraction n and Snell's law:
 - $n_1(sin i) = n_2 sin(r)$
 - vacuum: n = 1
 - air: n ≈1
 - glass: n = 1.5
- ► Reflection
- Dispersion
- ► Absorption
- ▶ Polarization: 2 perpendicular polarizers \Rightarrow extinguished light

Interaction of light with matter:

- Refraction: index of refraction n and Snell's law:
 - $n_1(sin i) = n_2 sin(r)$
 - vacuum: n = 1
 - air: n ≈1
 - glass: n = 1.5
- Reflection
- Dispersion
 - ► Use of a monochromatic light
- ► Absorption

▶ Polarization: 2 perpendicular polarizers \Rightarrow extinguished light

Content Chapter 2 (1 lecture)

Refractometry: estimation of the refractive index

THE POLARIZING MICROSCOPE

2 Polarizers



THE POLARIZING MICROSCOPE

2 Polarizers





Immersion method: Based on the difference between n_{oil} (known) and n_{mineral} (unknown)



Figure 3.1 in Nesse

Immersion method: Based on the difference between n_{oil} (known) and n_{mineral} (unknown)





Figure 3.1 in Nesse

Relief: positive $(n_{mineral} > n_{oil})$ vs. negative $(n_{mineral} < n_{oil})$





Becke line method:

Becke line: band of light around the mineral grain



Lens : *10 Aperture diaphragm: closed









Becke line method:

Lowering the stage (= increase the distance between the sample and the objective)⇒ the Becke line moves into the material with the higher index of refraction.



Image view by the eye

Plane of focusing

Objective

Stage/thin section

Guide to thin microscopy, Fig. 4-20





INTRODUCTION TO OPTICAL INDICATRIX

Optical indicatrix: 3D representation (ellipsoidal) of the variations of the refractive index in a substance. Each vector defining the ellipsoidal is proportional to the RI in the same direction.

OPTICAL INDICATRIX

Optical indicatrix: 3D representation (ellipsoidal) of the variations of the refractive index in a substance. Each vector defining the ellipsoidal is proportional to the RI in the same direction.

Isotropic minerals

- Isotropic substances: velocity of light is the same in all the directions ⇔ mineral in the isometric (= cubic) system.

- **Isotropic indicatrix** = sphere



For next week:

Reading: Chap 4-5 in Introduction to Optical Mineralogy

Lab:

Refractive index