Refractometry

Chapter 3 of Nesse

Refractometry

Defined

_____

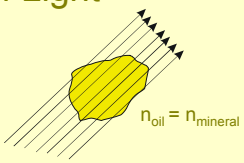
_____

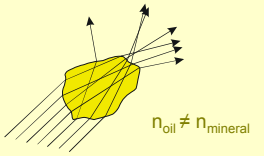
_____

- Requires having a set of immersion oils of _____ RI and comparing the mineral (unknown) to the oil

Refraction of Light

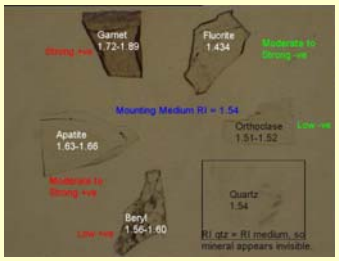
- If $n_{oil}=n_{mineral}$, light passes through the oil-mineral boundary un-refracted
  - the grain does not stand out
- If $n_{oil} \neq n_{mineral}$, light passing through the oil-mineral boundary is refracted
  - the grain appears to stand out

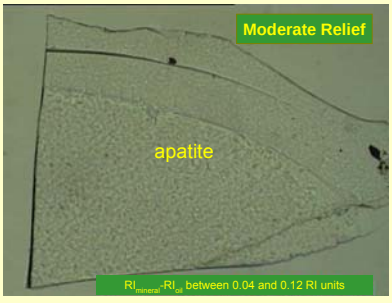


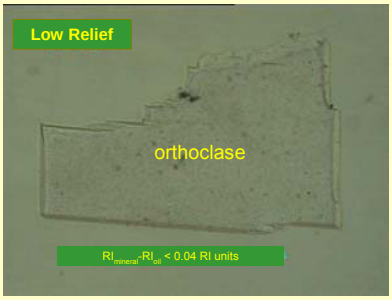


Relief

- **Relief -**





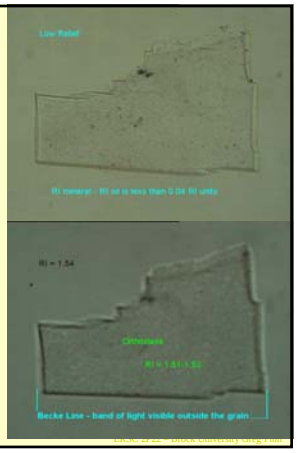


Relief

- Minerals may exhibit:
  - _____ **Relief**
    - $RI_{mineral} > RI_{oil}$
    - eg. garnet, RI =1.76
  - _____ **Relief**
    - $RI_{mineral} < RI_{oil}$
    - eg. fluorite, RI = 1.434
- Useful to know whether the mineral RI is > or < oil – **BECKE LINE METHOD**

Becke Line Method

- **Becke Line** –
  _____
  _____
  _____
  _____
  _____
  _____
  _____
  _____

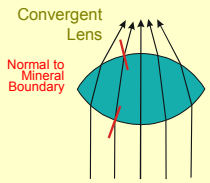


Becke Line Method

- Observing a Becke Line
  1. Use medium or high power
  2. Close down aperture diaphram
  3. For high power flip in the auxillary condenser
- **Lower the stage, the Becke line will move into the material with the higher RI**

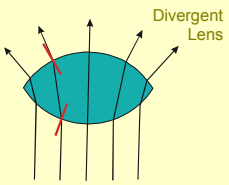
Lens Effect

$n_{min} > n_{oil}$



The mineral concentrates the light into a convergent cone above the mineral. The light is refracted towards the normal on entering the mineral and away from the normal on exiting the mineral.

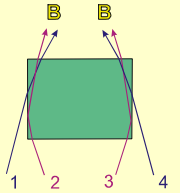
$n_{min} < n_{oil}$



The mineral acts as a divergent lens and concentrates the light around the margins of the mineral. The light is refracted away from the normal on entering the mineral and towards the normal on exiting the mineral.

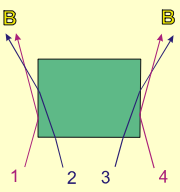
Internal Reflection

$n_{min} > n_{oil}$



Rays **1** and **4** are **refracted** into the mineral. Rays **2** and **3** are **internally reflected** because they strike the boundary at an angle greater then the critical angle. The Becke Line is formed by the concentration of light inside the mineral.

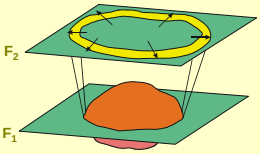
$n_{min} < n_{oil}$



Rays **2** and **3** are **refracted** out of the mineral. Rays **1** and **4** are **internally reflected** because they strike the boundary at an angle greater then the critical angle. The Becke Line is formed by the concentration of light outside the mineral.

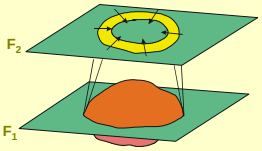
Becke Line Movement

$n_{min} < n_{oil}$



The cone of light diverges above the mineral grain. Lowering the stage from F_1 to F_2, the Becke line will appear to move out of the grain into the oil, i.e. into the material with the higher RI.

$n_{min} > n_{oil}$



The cone of light converges above the mineral grain. Lowering the stage from F_1 to F_2, the Becke line will appear to move out of the oil into the grain, again into the material with the higher RI.

Becke Line Movement

THE BECKE LINE WILL ALWAYS MOVE ONTO THE MATERIAL WITH THE HIGHER REFRACTIVE INDEX AS THE STAGE IS LOWERED

RI in Thin Section

- Becke lines will form at the boundary between two materials
- Compare the unknown to a substance of known RI
  - Epoxy, n = 1.54
  - Quartz, n = 1.544, n = 1.553