Mineral Observation

A- Plane-polarized light PPL (Unanalyzed Polarized Light or Natural Light)

Observe:

1- Shape of minerals
2- Color
3- Relief: Relief refers to the way a mineral appears to "stand out" when viewed in **PP light**. Sometimes we refer to a mineral as having high relief or low relief. Minerals with high relief have sharp grain boundaries, show fractures and cleavages well, and sometimes appear to stick out above other minerals in the thin section.
4- Cleavage: a property of minerals that gives them the ability to split easily along well-defined planes. Cleavage appears as lines on the mineral.
5- Pleochroism: the color changes when rotated 90° because minerals absorb polarized light differently depending on their orientation.
Pleochroism is defined as the color variation observed in anisotropic materials under a microscope when the specimen is rotated, resulting from destructive interference with the polarization direction of light.

B- cross-polarized light XPL (Polarized Light Analysis)

Observe:

1- **Interference colours, Birefringence:** if the crystal in the thin section does not deflect the light from the polarizer, the analyzer blocks the light: the mineral will appear black. In other cases, when the crystalline structure deflects the light from the polarizer, the analyzer lets colored light pass through, called polarization light. These colors depend on the crystalline structure of each mineral and allow them to be identified. The intensity of the colors varies as the plate is rotated (for a complete rotation, four positions of maximum intensity and four so-called extinction positions are observed).

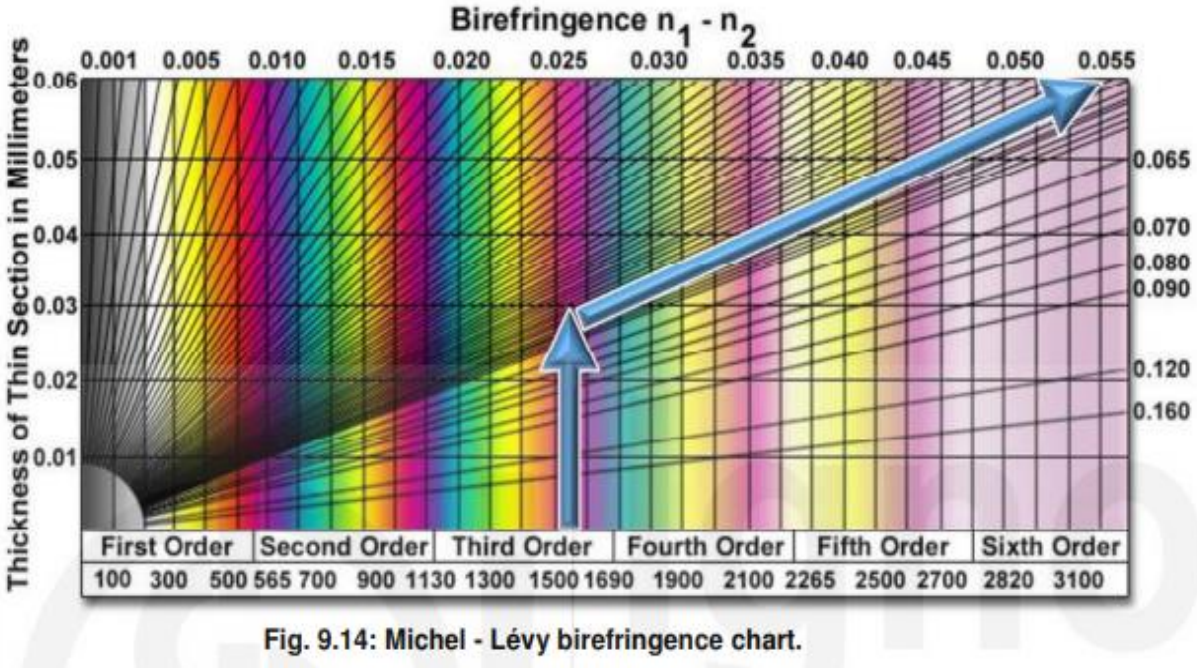

Fig. 9.14: Michel - Lévy birefringence chart.

Figure: Micchel Levy coulour chart

The physical property called **birefringence (δ_n, or $n_\gamma - n_\alpha$)** is plotted along diagonal lines across the diagram. The value of birefringence for each diagonal line is listed at the top and right sides of the diagram. Minerals are listed across the top and right side of the diagram next to their birefringence value

2- **Extinction:** Extinction angle is the angle between crystallographic direction and position of maximum extinction is called extinction angle. This angle is measured with reference to cleavage crystal outline or crack, twin plane. Four types of extinction are: (1) Straight extinction; (2) Oblique or Inclined; (3) Symmetrical extinction; (4) Wavy or undulose.

3- **twinning and zoning:**

twinning the variation in habit of minerals is due to significant variations in the conditions during crystallisation including pressure, temperature, etc. Two or more crystals of the same or related mineral species may intergrow with each other. Such crystals are called twinned crystals. Twinning is very commonly seen in feldspars.

Zoning is typical of minerals which form continuous solid solution series. It appears in form of concentric bands from centre outwards. Zoning reflects that mineral is compositionally not uniform throughout. Plagioclase is the best example of concentric zoning, in this we observe number of shells arranged concentrically around a central point

SUMMARY

basic concepts of optical mineralogy and the properties observed and studied under polarising microscope.

• Thin sections are examined in three positions: (1) ordinary light, (2) under plane polarised light, and (3) between cross nicols (ossed polars (XP).

• Under plane polarised light (PPL)

we study : colour, pleochroism, form**,**cleavage, relief, twinkling, and alteration and inclusions.

• Between cross nicols or crossed polars (XP) the study of:

isotropism/anisotropism, interference colours, extinction, twinning and zoning.
are carried out.

• The minerals have their individual diagnostic characteristics which are collectively used for identification.
• Pleochroism is the variation in colour resulting from differential absorption of wavelength in different directions. The twinkling effect is caused by rapid change in relief of minerals.
• When the vibration direction of the ordinary and extraordinary rays of isotropic minerals are parallel to vibration directions of nicols in a polarising microscope,
no light reaches the eye and the mineral is said to be in extinction position.
• Extinction can be straight or parallel, oblique or inclined, symmetrical, wavy or undulose.
• Twinning is very commonly seen in feldspars.
• Birefringence is a measure of the difference between the maximum and minimum refractive indices of particular mineral.