

DOUBLE REFRACTION

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Isotropic Materials	Anisotropic Materials
Atoms are arranged in a regular periodic manner	The arrangement of atoms are differs in different directions within a crystal .
When a light beam incident on this type of materials, it refracts a single ray	When light beam incident on these crystals it undergoes double refraction.
Refractive index will be same in all directions	Refractive index vary with directions
eg: glass,air,water	eg: Calcite,Mica,Quartz

- ▣ When a beam of ordinary light is passed through certain crystals, the refracted ray splits into two rays. This phenomena of splitting of a light ray into two refracted rays is called double refraction or birefringence.
- ▣ One of these rays obey snell's law of refraction and is called **ordinary ray(o-ray)**.
- ▣ The other which do not obey snell's law of refraction is called **extra ordinary ray(e-ray)**.

Properties of e -ray and o-ray

Ordinary ray	Extra ordinary ray
Plane polarised. Plane of polarisation is perpendicular to the plane of polarisation of e ray	Plane polarised. Plane of polarisation is perpendicular to the plane of polarisation of o ray
Within a crystal ,o ray travels at the same speed in all directions.	E ray travels at different speed in different directions
Refractive index of the crystal for o ray is constant.	Refractive index is different in different directions.
Wavefront is spherical	Wavefront is ellipsoidal

- ▣ **Birefringence**: The difference between refractive indices of extraordinary ray and ordinary ray ($\mu_e - \mu_o$)
- ▣ **Optic axis**: The direction within a doubly refracting crystal along which the o ray and e ray have same velocity is called optic axis.
- ▣ If there is only one optic axis in a crystal, it is called **uniaxial crystal** (Calcite, Quartz) whereas in **biaxial crystals** (Mica) there are two optic axes.

Uniaxial crystals are divided into two

Positive crystals	Negative crystals
Refractive index of e ray is greater $\mu_e > \mu_o$	Refractive index of o ray is greater $\mu_o > \mu_e$
Velocity of o ray is greater $V_o > V_e$	Velocity of e ray is greater $V_e > V_o$
Birefringence is positive	Birefringence is negative
Ellipsoidal wavefront of e ray within the spherical wavefront of o ray.	Spherical wavefront of o ray is within the ellipsoidal wavefront of e ray

THANK YOU...