Lab log assessment: reflection

# AIM:

To measure the reflectance of a dielectric material for s- and p-polarised light across a range of incidence angles. From the angular dependence, the Brewster angle was determined and, with Fresnel theory, used to estimate the refractive index of the sample.

# background equations

**Fresnel’s equation:**

When light is incident on an interface between two media (ni->nt), part of the light is reflected. The reflectance depends on the polarisation:

* s-polarised (When the electric flux is perpendicular to the incidence plane):
* p-polarised (When the electric flux is parallel to the incidence plane):

**Brewster’s** Angle:

The p-polarised reflectance vanishes when the Fresnel coefficient is zero (substitute for (1) = 0):

Hence, the numerator:

**Snell’s law**:

Dividing Snell’s law (3) by equation (2):

At Brewster's angle, the reflected and transmitted rays are perpendicular to each other:

Substituting (5) and (6) into (4):

Therefore, the Brewster’s angle can be written as:

# Raw Results

|  |  |  |
| --- | --- | --- |
| p-polarisation | | |
| Incident Intensity: | | 570 Lux |
| Angle (°) | Intensity (lux) | Error (±lux) |
| 10 | 18.1 | 0.1 |
| 20 | 17.1 | 0.05 |
| 30 | 14.15 | 0.03 |
| 40 | 9.66 | 0.01 |
| 50 | 3.45 | 0.1 |
| 55 | 1.03 | 0 |
| 57 | 0.65 | 0 |
| 59 | 0.38 | 0.01 |
| 60 | 0.72 | 0.03 |
| 62 | 1.83 | 0.01 |
| 65 | 3.57 | 0.01 |
| 70 | 16.24 | 0.02 |
| 80 | 95.5 | 0.01 |

|  |  |  |
| --- | --- | --- |
| s-polarisation | | |
| Incident Intensity: | | 15.26 Lux |
| Angle (°) | Intensity (lux) | Error (±lux) |
| 10 | 1.08 | 0.05 |
| 20 | 1.25 | 0.2 |
| 30 | 1.26 | 0.01 |
| 40 | 1.33 | 0.01 |
| 50 | 1.77 | 0.01 |
| 60 | 2.7 | 0.01 |
| 70 | 4.36 | 0.01 |
| 80 | 7.53 | 0.01 |

A graph with a red line and blue line

AI-generated content may be incorrect.

a brief aim (one sentence).

a diagram of the experiment with brief discussion of critical aspects of data collection

equations for Brewster angle and Fresnel curves with explanation of the concepts

measured value of Brewster angle with uncertainty

for each polarization, a data table of reflected intensities vs angle along with incident intensity and estimated uncertainty

a single carefully labelled graph that includes reflectance vs angle for each polarization, error bars and fitted curves

brief discussion about how data analysis was performed, with reference to the equations

refractive index estimate from both Brewster and Fresnel, with uncertainties

a comparison of these estimates and discussion about their reliability