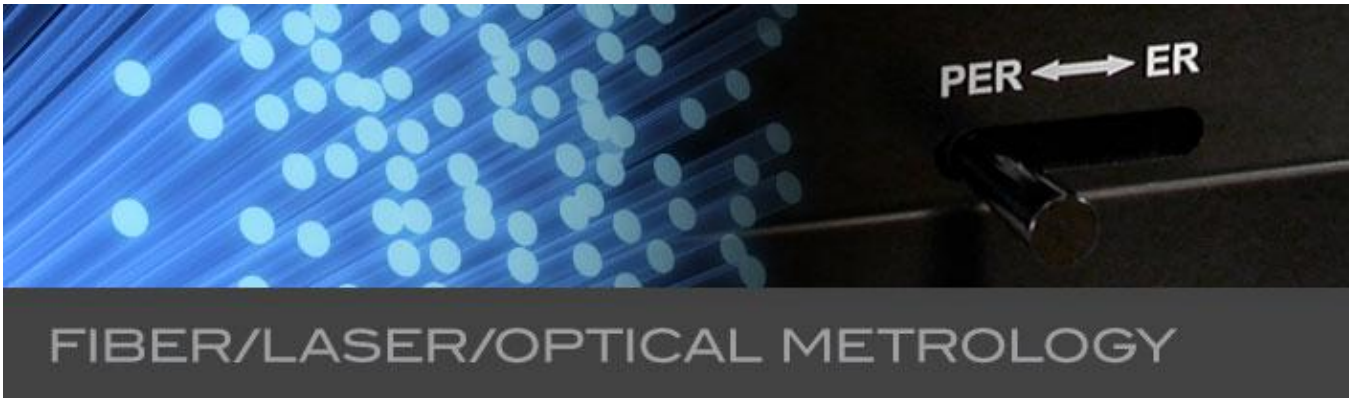


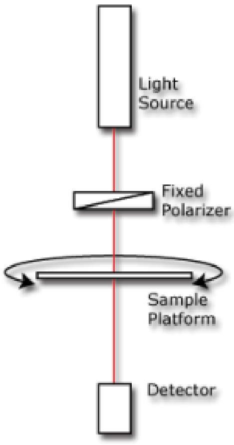
Metrology Measurement

The manufacture of optical components such as laser crystals and fiber optics can generate polarizing features. These induced features are sometimes desirable and other times undesirable, but in all cases they need to be characterized. Hinds Instruments has worked with optics manufacturers to develop techniques that will allow them to introduce profit-preserving quality control on their optical products.

Select your Fiber, Laser Crystal or Optical Metrology Application:

1. Extinction Ratio

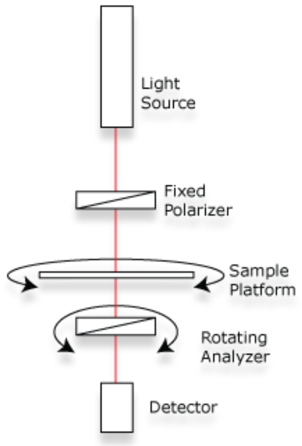
Hinds Instruments Extinction Ratio (ER) measurement instrument is combined with the Polarization Extinction Ratio (PER) instrument to provide a tool for measuring polarization properties of optical components. A block diagram of the instrument configured for ER measurement is depicted here.



ER is calculated as a ratio of the power transmitted when the sample polarizing element is aligned with the instruments polarizer divided by the transmission when the two elements are crossed.

2. POLARIZATION EXTINCTION RATIO

Measurement of samples like laser crystals can be done with a PER (polarization extinction ratio) system. The block diagram of this system shows that both the sample stage and analyzing polarizer are rotated to carry out this measurement of the power drop (in decibels) between the light transmitted when two polarizers are aligned around the sample and when two polarizers are crossed around the sample. The PER is calculated as the ratio of the two values.

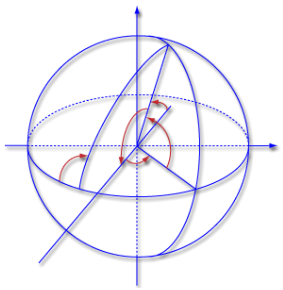


$PER_b = 10 \log \frac{P}{(C-B)}$ $PER = 10 \log$

3. State of Polarization (SOP)

The State of Polarization (SOP) and Degree of Polarization (DOP) are characterized by determining the 4 Stokes parameters of light.

SOP is represented as a position on the Poincaré sphere



$$DOP = \frac{\sqrt{Q^2 + U^2 + V^2}}{I}$$

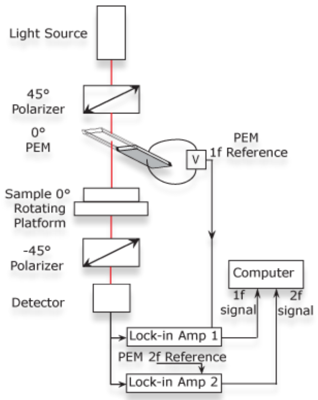
and DOP is calculated from the Stokes parameters, I, Q,U and V (sometimes represented as S_1, S_2, S_3, and S_4).

There are two ways that Hinds addresses your polarimetry needs. If you choose to build your own instrument we can supply you with the PEMs you need to modulate polarization in your experimental set up. We can also provide other accessories for the experiment, such as SignaLoc™ lock-in amplifiers and DET-100 signal detectors.

Hinds also sells "plug and play" polarimetric instrumentation. The Dual PEM Polarimeter determines the complete SOP and DOP of incoming light with impressive speed: it is capable of making more than 100 complete polarization measurements per second. The SOP is automatically plotted on the Poincare´ sphere and the DOP is calculated as well as the Degree of Linearly Polarized Light (DOLP) and the Degree of Circularly Polarized Light (DOCP). These values are archived and their change can be monitored over time. The Hinds Polarimeter is capable of determining the DOP to 0.0005 of a Stokes vector.

4. Waveplate Measurement

Wave-plates are an important optical component for light polarization-related measurements. The PEM can be employed to determine both the amplitude and orientation of the retardation of a wave-plate.



SETUP EQUATION

$$B = \frac{\pi}{2} - \tan^{-1}\left[\frac{J_1(A_0)}{J_2(A_0)} \bullet \frac{I_{2f}}{|I_{1f}|}\right]$$

I_{1f}: 1f signal
I_{2f}: 2f signal
A_0: PEM's retardation setting
$J_2(A_0)$: 2nd order Bessel function
$J_1(A_0)$: 1st order Bessel function

In this set-up, either the fast axis or the slow axis of the quarter-wave plate is required to be parallel to the PEM's optical axis. The positive and negative signs of I_{2f}, after calibration, indicate which axis (slow or fast) it is.