1/ Spectroscopic Ellipsometry:

Spectroscopic Ellipsometry is a surface sensitive, non-destructive, and non-intrusive optical metrology technique, in which the sample to be characterized is illuminated with a beam of polarized light.

It is widely used to determine thin film thickness and optical constants (n, k).

Spectroscopic Ellipsometry is ideal for a wide range of thin film applications from fields such as semiconductors, solar, optoelectronics, optical and functional coatings, surface chemistry, and biotechnology.

2/ Advantages of Ellipsometry:

- Non-destructive technique.
- No sample preparation.
- Rapid measurement and no reference measurement needed.
- Very sensitive for thin film down to 1 A°.
- Excellent technique for multi-layers measurement.
- Direct and accurate determination of optical constants (n,k).

3/ Thin Film Measurement Capabilities:

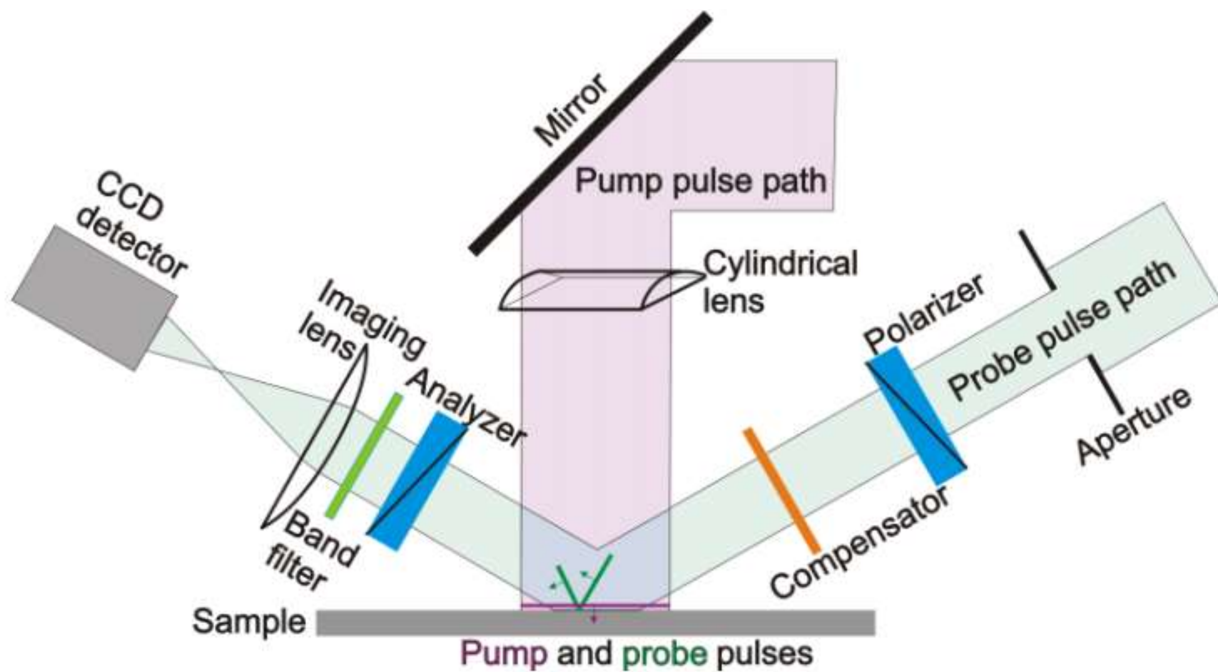
Ellipsometry measures the change in polarization state of the measurement beam induced by reflection from (or transmission through) the sample.

This measure characterized by the ellipsometric Psi and Delta parameters.

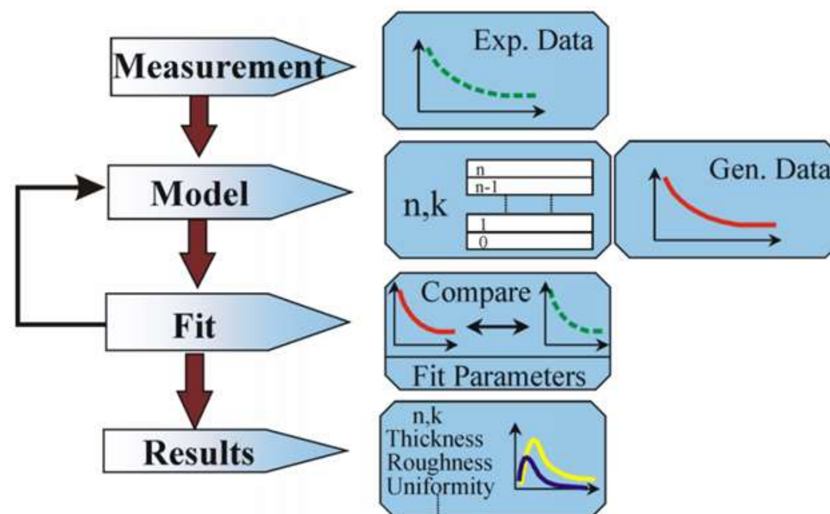
Convert the SE data to the p representation, which is given by:

$$\rho = \frac{r_p}{r_s} = \tan \psi e^{i\Delta}.$$

where the angles Ψ and Δ are the standard ellipsometric angles representing the change in amplitude and phase shift, respectively, upon reflection.

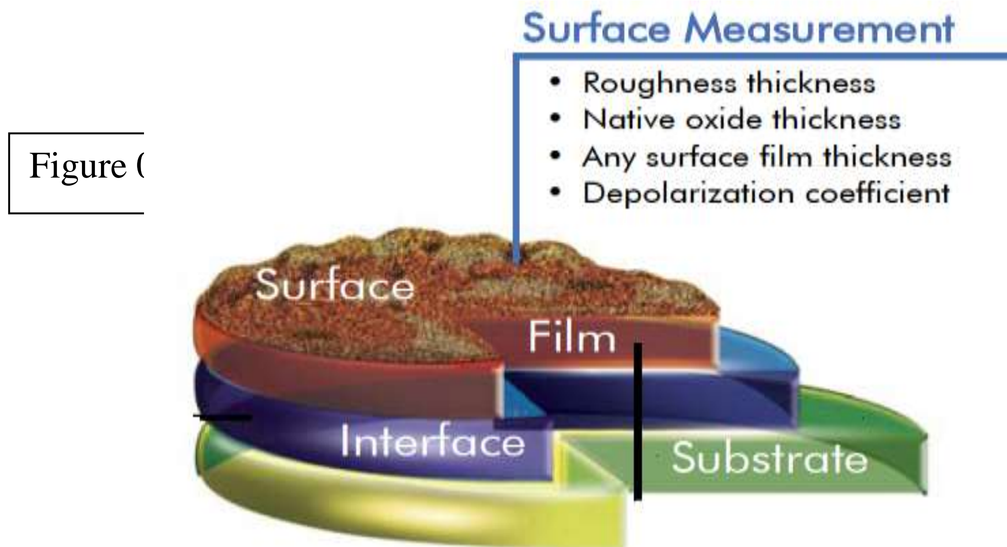


Data analysis is a very important part of spectroscopic ellipsometry (SE): without data analysis, SE measures only the ellipsometric parameters Psi and Delta versus wavelength. To determine sample properties of interest, such as layer thicknesses and optical constants, a model-based analysis of the SE data must typically be performed. The only exception to this is in characterizing the optical constants of bulk samples, The model-based analysis approach is summarized by the flowchart shown in Figure:



SE Data Analysis flowchart.

a- Surface Measurement: as shown in figure 02.



b- Interfacial Behaviour:

. Interface thickness.
. Composition of mixed materials forming interface.
. Film growth, adsorption.

c- Optical Properties:

. Optical constants (n,k) and α.
. Optical bandgap E_g.
. Transmittance, Reflectance.

d- Material Properties:

. Microstructure information, composition, crystallinity.
. Film porosity.

4/ Materials Range:

a- Substrate: Si, GaAs, Glass, Sapphire, Plastic, Metals.

b- Film Materials: Semiconductors, Dielectrics, Thin metal, transparent conductors, Polymers and Organic materials.