

Application Report: Characterising of various types of coatings: example of ellipsometry measurements

An example of the services provided by MATinspired is the characterising of applied coatings, to either determine or check quality. Various techniques are available for characterising a divergent array of layers: from extremely thin coatings with thicknesses in the order of nanometers up to layers of hundreds of micrometers thick.

Examples of layers for characterising are:

- Vapour deposited layers (titanium nitride, silicium nitride, indium tin oxide, silicon carbide, etc.);
- Oxide layers (iron oxide, titanium oxide, aluminium oxide, etc.);
- Various semiconductor layers (II-V materials, photoresist layers, solar cell layers, etc.);
- Plated layers (gold, copper, chrome, zinc, etc.);
- Paint layers;
- Organic layers;



Figure 1. The ellipsometer in the MATinspired lab can accurately determine the thickness of thin coatings.

Ellipsometry

The layer thicknesses of applied coatings can be determined with nanometer accuracy using the recently acquired Horiba Uvisel Ellipsometer; see Figure 1.

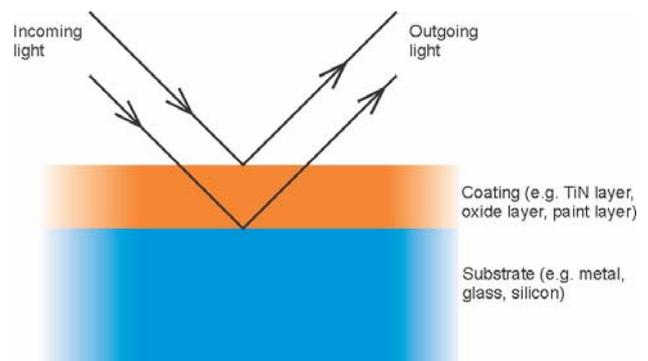


Figure 2. Highly simplified diagram of the working of an ellipsometric measurement of a thin coating.

Figure 2 shows schematically how the ellipsometer works. In most cases, thinly applied coatings are partially transparent. Ellipsometry uses polarised light that falls onto the sample at a specified angle. Part of this light is reflected directly by the surface, but part of it passes through the coating and is reflected by the substrate (e.g. metal). This impacts the intensity of the total outgoing light. The polarisation direction of the outgoing light is also different. The intensity and polarisation of the outgoing light are measured at various wavelengths. Then, with the help of a computer model, the thickness of the layer is determined to a high degree of accuracy. The advantage of ellipsometry is that measurements are done rapidly and that there is no need to prepare a sample. Measurements can be conducted directly on the sample itself (non-destructive).