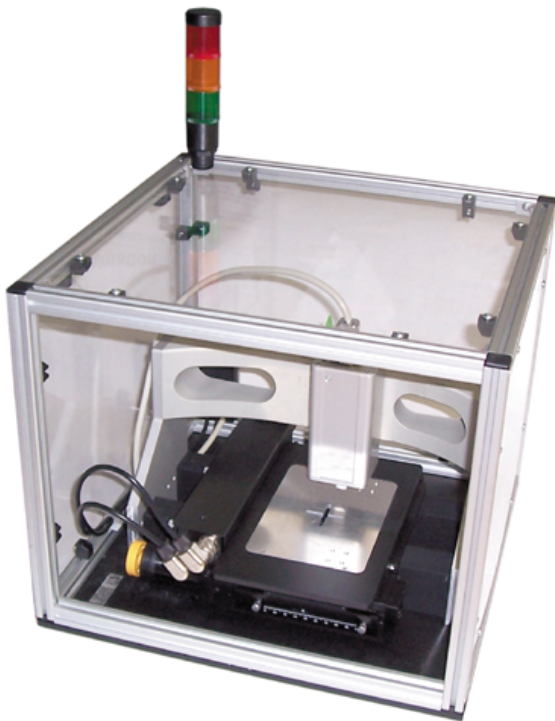


Applications of Non-contact Metrology in the Field of Films and Coatings

Modern production methods for films and sheet materials are nowadays introducing an ever-increasing degree of flexibility. State-of-the-art techniques allow coating or finishing of a very wide range of different materials, with ever-more stringent demands being placed on materials and processes.

These developments also lead to increased demand for quality assurance and control of production processes.



SemDex F12 Complete System for measuring foils and layers fully automatically.

For example, during film production at web speeds of up to 1600 m / min several hundred metres of film are produced or coated within just a few seconds. Any flaw occurring not only means that the film produced is defective, but that high disposal costs are frequently also incurred.

There is thus an urgent need for a measuring system which can detect such faults at a very early stage and deliver appropriate feedback signals.

This need is met by the in-line measuring system developed by the Mannheim-based company **ISIS sentronics** which can measure the total thickness of a material as well as the thicknesses of the individual layers, even at very high web speeds.



StraDex f2 Sensorhead

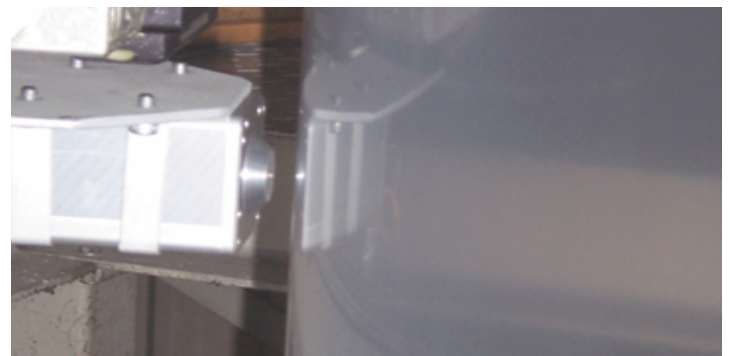
The optical interferometric system permits completely non-contact measurement.

Having an integrated autofocus system, the **StraDex** sensor in particular is able to perform real-time in-line measurements. Owing to the nature of the production process, the film may "flutter" up and down by up to several centimetres.

Yet measurement is still feasible because the sensor's integrated autofocus function enables the system to recognise and automatically follow such movements.

As an option, the **StraDex** sensor can be mounted on a traversing unit, thus permitting measurement over the entire width of the film web.

Films are produced by a wide variety of methods. In blown film extrusion the film travels over a ring traversing unit and is drawn upwards in tubular form. Here too, a single sensor of the **StraDex** series suffices to measure both the layer thickness, and also the thickness distribution of the respective individual layers.

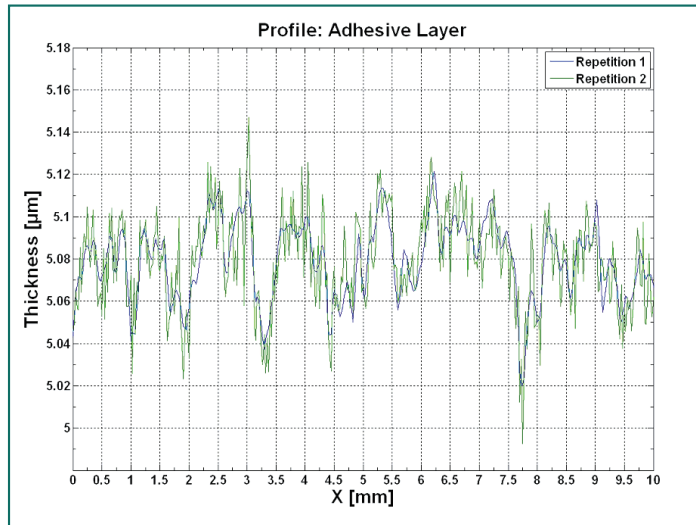


StraDex f2 Sensor on traversing unit during blown film extrusion

It is particularly noteworthy that the sensor affords all the desired results from just a single measurement, namely total thickness, individual layer thickness, and the respective distribution of the layers.

It is absolutely immaterial whether the materials are wet or dry. Measurement of adhesive layers represents a particular challenge. First of all, the adhesives are usually solvent-containing substances subject to special safety regulations.

The StraDex sensor is therefore enclosed in a special housing approved for use in explosion risk areas. After application of the liquid adhesive the sensor measures the thickness distribution of the layer and the thickness of the respective substrate at the same time. Possible defects are discovered immediately and can be corrected before large quantities of material of dubious quality are produced.



Thin adhesive layer measurement for a 10 mm profile length. Nominal adhesive layer thickness = 5 µm. Repeatability = 30 nm. Measurement performed with a StraDex f-2 80 sensor head

Food packaging films contain so-called barrier layers intended to prevent premature spoilage of the foods they contain. Such barrier layers consist, for example, of EVOH, which is a very expensive material. In the manufacturing process a certain minimum thickness stipulated for these barrier layers must be observed under all circumstances. However, application of excessive material should be avoided in order to keep costs under control.

Since a barrier layer is usually an intermediate layer, measurement of its thickness will constitute a challenge for many measuring systems.

The **StraDex** sensor permits through-layer measurement until the system finds the layer to be measured on the basis of the different refractive indices of the individual materials – **both in-line in the course of production and also in off-line mode.**

The **StraDex** sensor is available in various configurations:

StraDex p-80: Permits measurement of very thin individual layers down to a thickness of 5 µm at a total layer thickness of up to 100 µm

StraDex f-300: Permits measurement of very thick materials (up to 350 µm) with individual layers from 12 µm

A distinctive feature characterising measurement of the individual layers is the fact that ISIS technology permits distinct layers of the same optical density (i.e. same materials) which are separated by a different layer to be represented as such.

Thus a StraDex sensor will measure a PA/PE/PA layer precisely as such, and not give the result as 2xPA+PE (sum of equal layers).

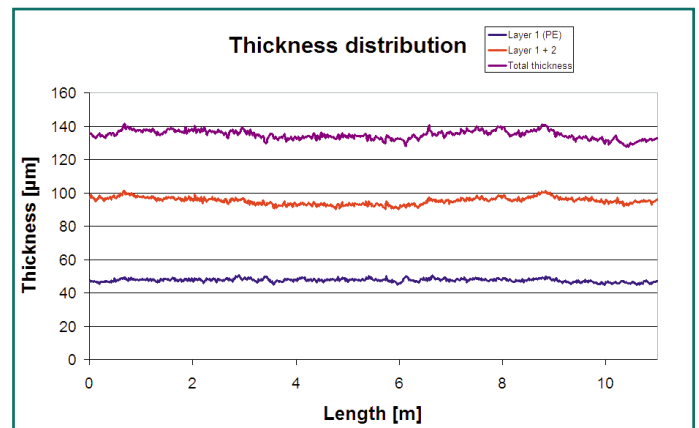
The StraDex sensor has numerous applications:

- Production and coating of films
- Blister packs (e.g. for pharmaceuticals)
- Medical tubing and catheters
- Coated paper (paper finishing)
- Coated glass
- Coated and finished (painted) metals
- Finished textiles (coated)

ISIS sentronics offers both off-line systems as well as equipment for in-line measurements. For example, incoming goods inspection can benefit from the advantages of the **F12** (off-line film measuring system); the samples to be examined are placed in the system for fully automatic measurement.

The **F12** system can be pre-programmed with certain measuring protocols which can be called up as required for the pertinent samples merely by pushing a button, with no need for any programming skills.

In the case of coated materials (sometimes with clear lacquers or other finishing substances) it is particularly important to verify a uniform distribution of the protective or finishing coating.



Three-layer measurement during production.

The layer thickness profile was recorded at a production speed of 140 m/min by a StraDex f2-300 sensor operating at a very high acquisition rate. The sensor was mounted on a linear traverse. Measurement was performed along the direction of production and displayed graphically.

ISIS sentronics – the spin-off company of ISIS optronics GmbH – was founded in 2006 by CEO Dr. Alexander Knüttel, and in addition to clients from the film and coatings sectors has also been serving the market segments automotive / mechanical engineering, medicine / medical technology, and wafer / semiconductor engineering since its foundation. The Mannheim-based company employs about 30 people.