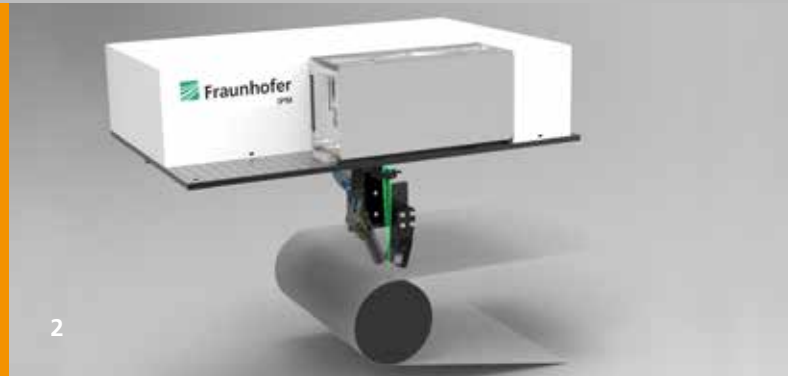




1 Corrosion protection coatings on metal strips should be homogeneous and coat the metal completely. The ANALIZEsingle measurement system measures nanometer-thick layers during the coating process.

2 The layer thickness measurement system ANALIZEsingle displays an image of the layer thickness distribution.



## ANALIZESINGLE

### FAST, PRECISE COATING THICKNESS MEASUREMENT AND ELEMENT ANALYSIS

The optical surface analysis methods ANALIZEsingle and ANALIZEmulti capture the element composition on the surface of a component within milliseconds per measuring point. The systems are suitable for measuring the composition and thickness of coatings as well as for determining the composition of bulk materials.

#### Principle

The underlying technology is Laser-Induced Breakdown Spectroscopy (LIBS), where a short pulse laser ablates a tiny amount – typically just a few  $\mu\text{m}^3$  – from the surface, transforming it into a plasma. This plasma emits with a material-specific light spectrum. The spectral distribution of the light is recorded immediately in real-time. From this data, the element distribution at the measuring point is determined.

ANALIZEsingle determines the thickness of coatings from the analysis of a single laser pulse by comparing the spectral signatures of the coating material and the component material from a single spectrum. ANALIZEsingle measures the thickness of coatings with an accuracy of  $\pm 10$  percent. Layers of 1 nm to 1  $\mu\text{m}$  in thickness are analyzed using this method. ANALIZEsingle is offered as a laboratory and an inline test and inspection system.

#### Areas of application

One application case is the testing of metal layers on metal, for example copper coatings for electronic assemblies. In addition, corrosion protection coatings on metals can be analyzed. Numerous other functional layers such as passivations, finishes, or

#### Fraunhofer Institute for Physical Measurement Techniques IPM

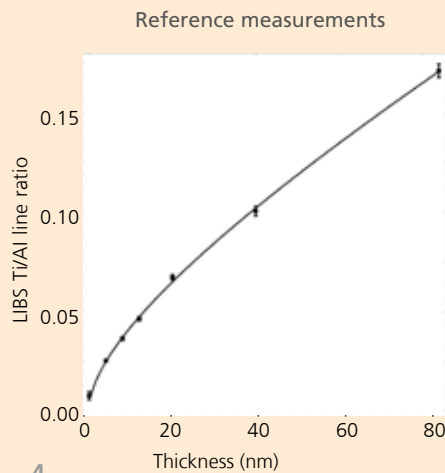
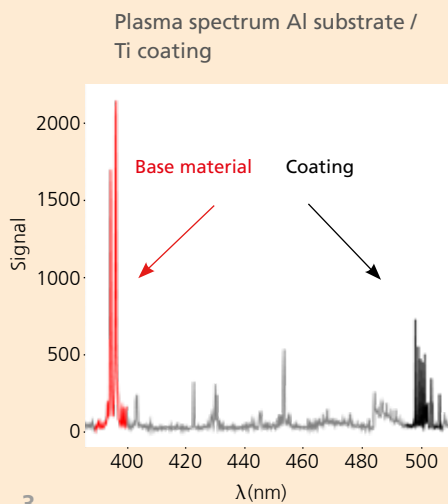
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3 Plasma spectrum of a 30 nm thick titanium polymer coating on an aluminum substrate.

4 The measurements with ANALIZEsingle are either calibrated with an X-ray fluorescence analysis on a reference sample, or – as shown here – with a sputtered reference sample.

protective coatings can be characterized quickly and reliably in this way.

### Example: Corrosion protection coatings on aluminum strip

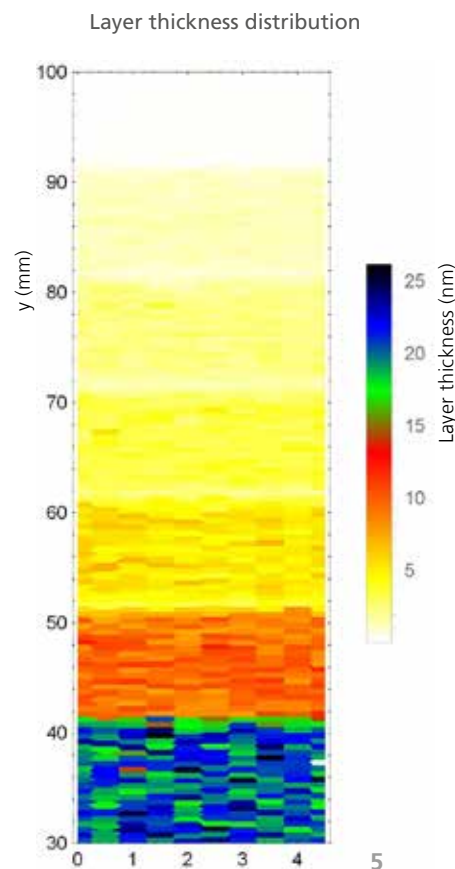
In addition to chromium, protective coatings made of titanium, zirconium, or silicon are used to protect against corrosion and to promote adhesion on aluminum. The homogeneity of the coating depends on the method of application and the chemical reactivity of the alloy components. Quantification of the coating thickness is very useful here to monitor the process and prevent rejects. With the aid of ANALIZEsingle, the thickness is analyzed in real-time directly after application and along the entire length of the metal substrate.

### Inline system and lab analytics

Fraunhofer IPM offers ANALIZEsingle as a lab system as well as for integration into the production line.

The inline system is integrated into industrial processes (e.g. in sheet metal production) and is installed on a fast moving conveyor, for example. The optical access point is typically located on a deflection roller so that the position of the sheet metal with respect to the optics is well defined. At certain predefined times, a laser pulse is emitted and the spectrum is recorded. The spectra are evaluated in real-time so that information on the coating thickness or the composition of the material is available immediately.

For lab analytics, the components to be analyzed are placed in the lab system. The spectra are taken fully automatically at previously defined positions. Similar to the inline system, the raw data is evaluated immediately after the spectra are recorded. In the context of quality control, this enables the testing of random samples of components.



5 Aluminium sheet with locally different coating thickness between 1 and 20 nm.

#### ANALIZEsingle system specifications

Measurement range, coating thickness	1 – 1,000 nm
Measurement accuracy, layer thickness	± 10 %
Coating materials	Metallic coatings containing silane, phosphate
Measurement rate	100 Hz
Laser spot size	80 μm
Resolution	200 μm
Measurement distance	2 – 10 cm

All specifications and features are subject to modification without notice.