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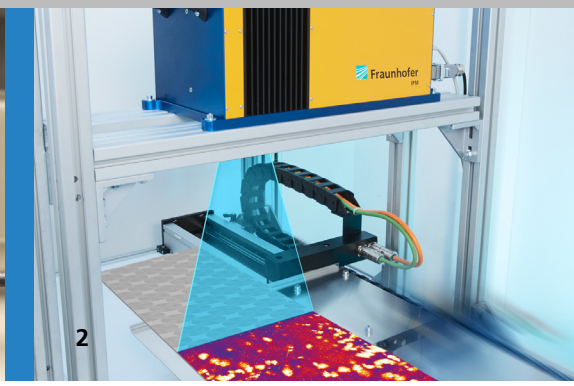

1 *Faultless sheet metal lubrication is an important quality factor in further processing.*
2 *The »F-scanner« detects oil distribution during production. Evaluation is performed in real-time, allowing automated process optimization.*

IMAGING OIL FILM MEASUREMENT

AUTOMATICALLY AND IN REAL-TIME

Thin oil films fulfil three important tasks in sheet metal production: They protect metal sheets from corrosion, prevent mechanical damage, and improve the friction behaviour of the sheets when being formed. The exact oil dosage is decisive: During the forming process, it is crucial to oil the points of a component that are particularly prone to deformation. Corrosion protection requires uniform and complete distribution of the oil film. That is why somewhat thick oil films are often used. This can lead to quality problems in oil-sensitive downstream processes such as gluing, painting, welding, or electrical contacting.

Quality through inline measurement technology

It is therefore advisable to measure the homogeneity and thickness of the oil layer during production. Conventional inline measuring systems perform selective surface measurements only. The sensor traverses the sheet metal surface perpendicular to the feed direction. Fast sheet feed results in a zig-zag measuring line. The unmeasured spaces add up to critical measurement gaps of several square meters.

Fluorescence scanner for comprehensive oil film measurement

Only comprehensive oil film measurement can reliably determine the actual oil distribution on a sheet. The »F-Scanner«, an imaging fluorescence measuring system from Fraunhofer IPM, detects the thickness and homogeneity of oil films and dry lubricants in real-time – on flat sheets as well as on complex 3D stamped parts. No preparatory homogenization of distribution is necessary. The »F-Scanner« scans the surface of the sheet metal point by point with a

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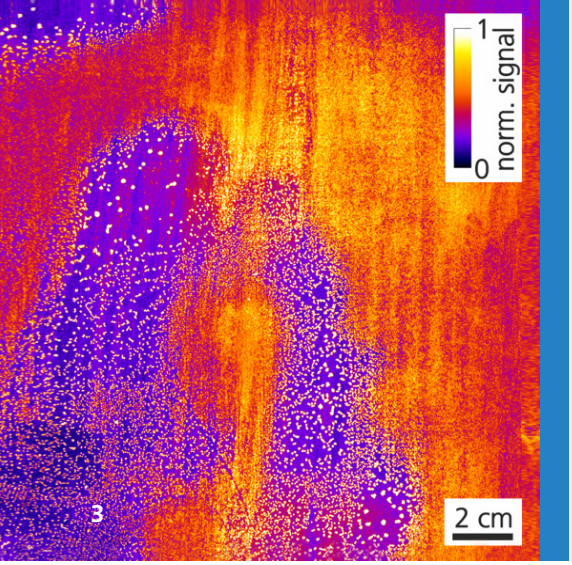

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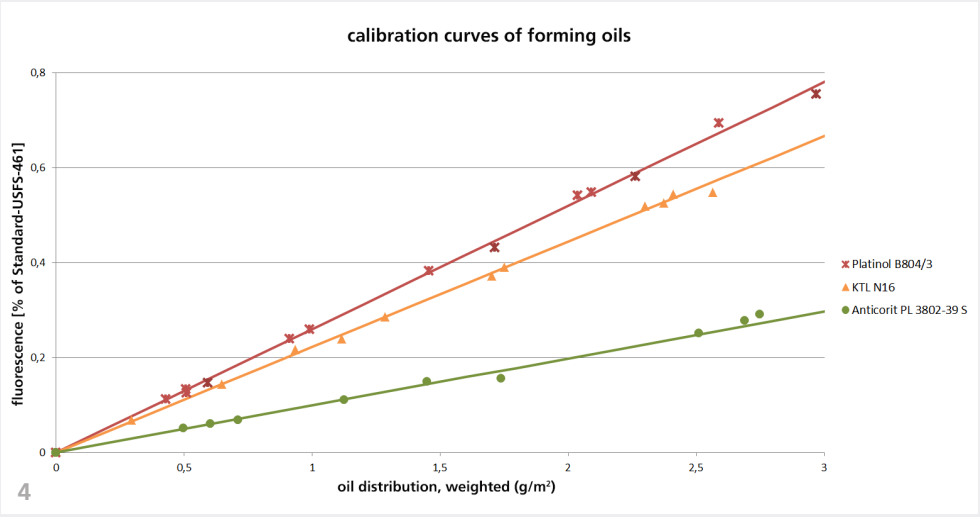

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UV laser. The system scans the entire width of the sheet perpendicular to the feed direction. It is adjusted to the feed speed so as to allow complete measurement of oil distribution. At a sheet metal feed rate of 2 m/s, the »F-Scanner« scans the surface at a scanning speed of 400 Hz and intervals of 5 mm: the measuring system does not miss any misoiling.

Fluorescence allows high-resolution surface detection

In the UV wavelength range, most substances used for sheet metal oiling exhibit strong fluorescence activity, meaning that the oils convert part of the UV light into visible light. Most inorganic materials – an unoiled sheet metal surface is of special interest here – do not behave in this way. Spectral filtering is used to evaluate oil fluorescence, providing high-contrast and unambiguous measuring images of oil layer thickness and homogeneity across the entire sheet surface. After calibration, the oil layer is measured to an accuracy of +-0.05 g/m²; the oiling detection limit is in the range of 0.01 g/m². Dry lubricants and forming and corrosion protection oils can be measured without pre-treatment. Oiling errors are reliably detected, allowing timely intervention in the process.

Fast, sensitive surface scanning

The extremely fast laser scanner makes inline, fluorescence-based imaging oiling measurement possible for the first time. The scanning system can be adapted to feed system widths of up to 4.2 m. This allows high area throughput while retaining high sensitivity. The signals detected are combined to form a spatially resolved overall image. The collimated laser beam gives the system great focus depth. Nor is monitoring limited to rollstock: components with complex 3D free-form surfaces can also be completely inspected. The UV laser beam scans the entire object.

Automated image processing based on pattern recognition makes it possible to evaluate and categorize fluorescence images in real-time. If the defined oil distribution maximum value is exceeded or the minimum not reached, the next process step can be adapted: The component is pulled off the line and the spot is marked or the lubrication quantity adjusted. In this way, spatially resolved evaluation helps to assess and document the quality of oiling in the production line and thus to optimize it continuously.

3 Comprehensive measurement of the oil content allows detection not only of changes in thickness, but also of structures such as droplets.

4 The fluorescence signal allows precise measurement of oil film thickness.

Technical specifications

Fluorescence excitation	UV typ. 405 nm
Detection	VIS typ. 420-520 nm
Detection area	several m²
Scan speed	400 lines/sec; for example, 5 mm line spacing at 2 m/s feed rate
System dimensions (L × W × H)	60 × 60 × 30 cm³
Oil layer measurement precision	+-0.05 g/m²
Pattern recognition	inline capable evaluation of oil distribution

»F-Scanner« at a glance

- 100% inline surface inspection
- speeds in the m/s range at high resolution
- high sensitivity
- measurement of all relevant distributions without pre-treatment
- little space required, no traversing
- flexible positioning on the line
- automated image processing allows classification of different types of defects
- complete CE documentation