On the trail of rust

Evaluate corrosion test panels quickly and objectively

by Peter Gips

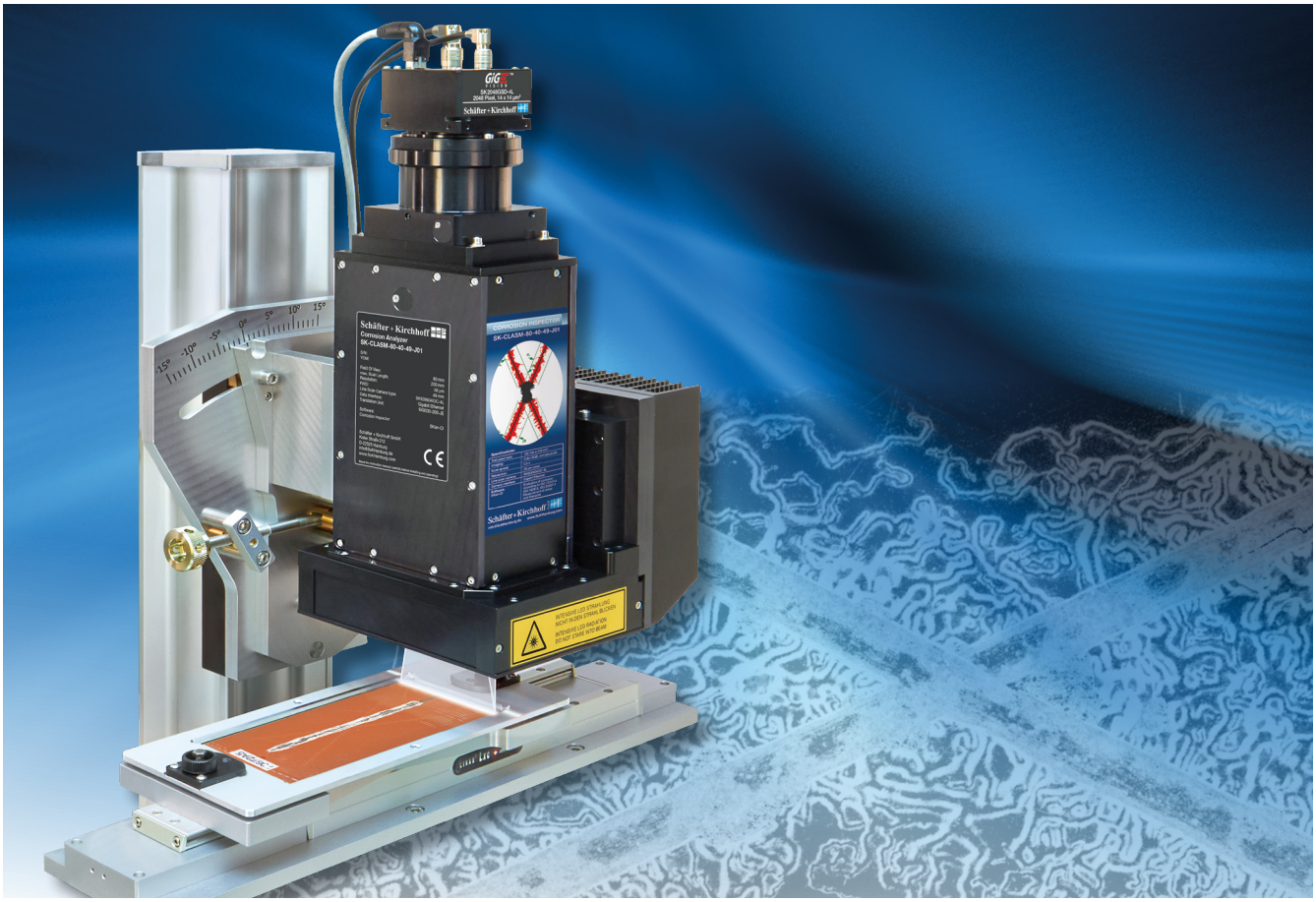


Fig. 1:
The „Corrosion Inspector“ scans a standardized test panel in only 0.8 s and with a resollution of 22 µm per pixel.

The „Corrosion Inspector“ is a color scanner system for the fast and objective evaluation of filiform and other corrosion phenomena, developed by the Hamburg-based company Schäfter+Kirchhoff.

Schäfter+Kirchhoff GmbH | Kieler Str. 212 | 22525 Hamburg, Germany | +49 40 85 39 97-0 | info@sukhamburg.de | www.sukhamburg.com

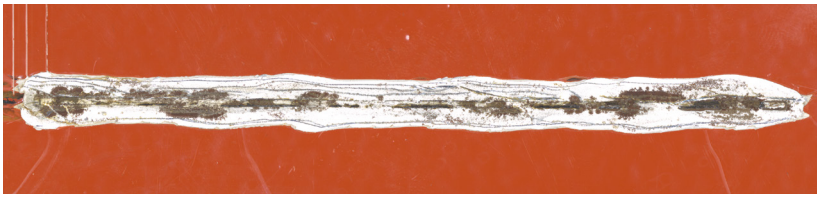
During the development of coating systems with improved corrosion protection and as part of the quality assurance of coated-components, a large number of test panels are produced. These coated test panels are scribed and exposed to weathering in special climatic chambers. Up to now, it has been common practice to evaluate the induced corrosion phenomena manually and visually - a very tedious task that is time-consuming, error-prone and subjective. A magnifying glass with integrated scale is often used as an aid.

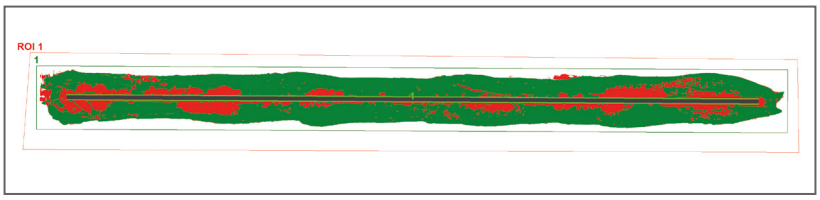
Schäfter+Kirchhoff have developed the „Corrosion Inspector“ to accelerate and objectify the evaluation of filiform and other corrosion phenomena on test panels. The latest generation device now scans the samples in color.
Among other things, it enables the automatic evaluation of red rust areas and the calculation of their relation to other background areas. The evaluation of filiform corrosion and the measurement of filament lengths continue to be performed on the monochrome image.

Automatic evaluation

The system scans a standardized test panel in 0.8 s and provides a high-contrast image with a resolution of 0.022 mm. When using the automatic procedure, the evaluation of a sample plate including documentation and image storage is completed in 5 s. In addition to the time savings, the system is characterized by the variety of implemented evaluation methods. Implemented are for example:

- Filiform corrosion according to ISO21227-4
- Mean infiltration width UF
- Thread length ranking, maximum thread length
- Evaluation according to GSB
- Delamination and corrosion according to ISO 4628-8
- Stone impact resistance test (ISO 20567-1)





Korrosion Enthaftung Analyse
Auftrag: FreiLacke
Belastungszeit: 1100h
Prüfer: Mustermann

Proben-ID:	70672B12	**Scanzeit:**	22.02.2018 | 10:23:52
Bemerkung:	Testplatte		

ID	w [mm]	l [mm]	AC [mm²]	C [mm]	AD [mm²]	D [mm]
1	0.82	114.30	191.58	0.84	831.54	3.64
Gesamt	**0.82**	**114.30**	**191.58**	**0.84**	**831.54**	**3.64**

DIN EN ISO 4628-8:2005:
w = scribe width, l= scribe length
Al = w * l [mm²]
AC = corrosion area [mm²]
C = AC - Al / 2l [mm]
AD = delamination area [mm²]
D = AD - Al /2l [mm]

Fig. 2:
Automatic evaluation of corrosion and delamination using the color scanner system „Corrosion Inspector“. The Scanner detects red rust areas and measureshe effected area as well es the delamination area. The scribe area is subtracted from both areas.

The sample shown in the picture was kindly provided by the company FreiLacke, Döggingen, Germany.

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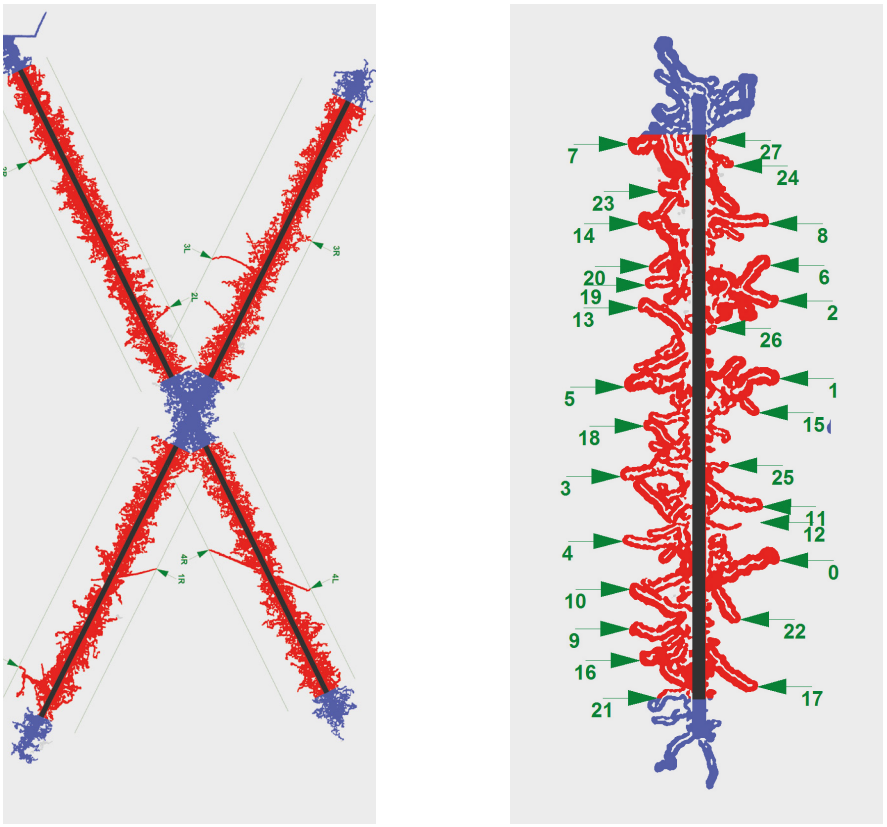

Fig. 3:
Automated evalution of various corrosion parameters of different scribe pattern. Among other things, the infiltration area, the average infiltration width, length and number of threads are measured.

Reproducible results

For selected scribing patterns, the software automatically detects the scribe position; manual definition of the scribe position is also possible. Among other things, the infiltration area, the average infiltration width, length and number of threads are measured.

The mean infiltration width is determined both by complete scanning of the contour with a resolution of 22 µm and by measurements at an adjustable number of equidistant measuring points along the scribe. True color analysis is used for measuring corrosion and delamination areas, as well as for stone chip testing. If taken into account in the paint structure, the system uses color measurement to detect the impact depth when testing the stone impact resistance of specimens with a multi-layer paint structure.

Immediately after the measurement, the „Corrosion Inspector“ displays the results graphically and numerically on the monitor. For each measurement, the operator enters documenting process data such as the name of the inspector, test method, exposure time and specimen ID via a dialog mask. For serial measurements, the specimen ID is automatically incremented after each new scan. In the export, Corrosion Inspector saves the result image together with the original image and the overlaid image, as well as an Excel or Calc spreadsheet (LibreOffice) in the selected folder. In addition, the program documents all image processing operations performed that led to this result to ensure the reproducibility of the measurement results.

The „Corrosion Inspector“ also offers convenient tools for manual measurement, with which even the smallest details can be measured on the monitor in the enlarged view.

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Technical data
„Corrosion Inspector SKan-CI-C“

Total measurement time	max. 5 s
Sensor	SK6288GKOC+LED-80-49
Measurement area	max. 80 mm x 200 mm
Free working distance	49 mm
Resolution	40 µm/pixel (25 pixels/mm)
Depth of focus	+/–1.2 mm (2z = 2.4 mm für k = 8)
Line scan camera	SK6288GKOC-L
Number of pixels, size	3 x 2096 (RGB), 14 µm x 14 µm
Line frequency	max. 9.3 kHz
Characteristics	Integration Control
Interface	Gigabit Ethernet
Operating temperature	+5 ... +45°C
Illumination	LBH96-01-500K-H-90-75
LED line light	coaxial, white (5000K)

Interface	RS232, software controlled
Adapter console	rotatable, +/–15°
Translation unit	SK8030-200-JE
Drive	mono block linear motor, resolution 1 µm
Scan length	max. 200 mm
Scan velocity	max. 250 mm/s
Object carrier	height adjustable table, lift range 40 mm
Test panel holder	length and depth stopper, press-in frame
Total system	
Power supply	voltage: 110–240 V AC power consumption: max. 90 W
Interface to the PC	1x Gigabit Ethernet
Dimensions (B xT x H)	460 mm x 300 mm x 700 mm
Weight	34.0 kg

Conclusion

The „Corrosion Inspector“ is used for a fast and objective evaluation of filiform, red rust and other corrosion phenomena on coated test panels. The scan time for a standardized test plate with a size of 100 mm x 200 mm is 0.8 s. The automatic evaluation of corrosion according to different standards requires approx. 5 s for one sample. The high imaging quality of the system also allows convenient interactive measurement of various corrosion phenomena.
A customer-specific adaptation of the evaluation procedures is possible.

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