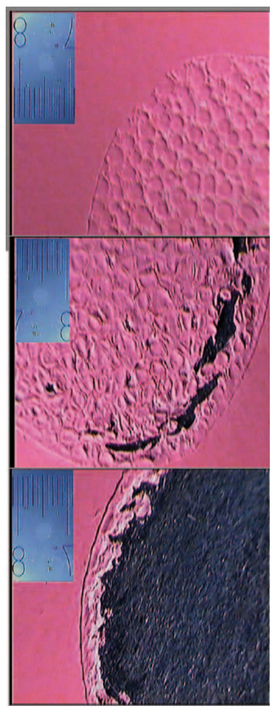
High-throughput-analysis of chemical resistance by gloss measurement

G. Meichsner, R. Hiesgen, S. Linder, Esslingen Univ. of Appl. Sci., Esslingen, Germany
R. Emmerich, T. Burk, Bosch Lab Systems, Waiblingen, Germany

BOSCH
Invented for life

Parameters of chemical resistance of a coating

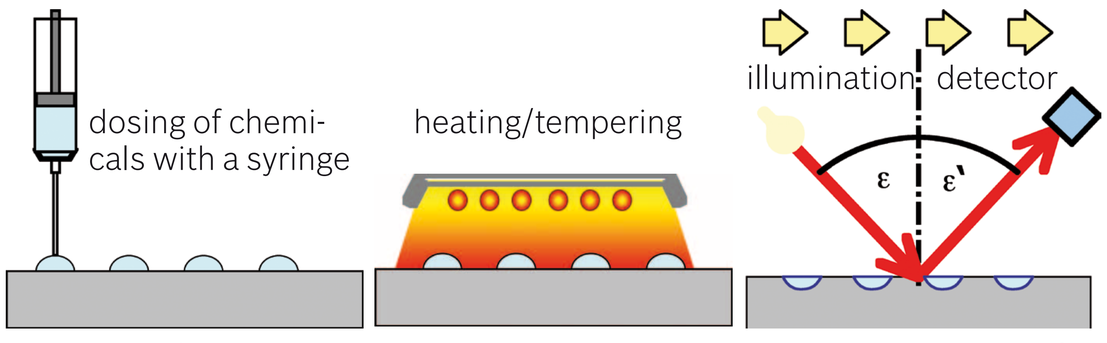


resistance of coatings against chemical influences is a function of

- temperature
- solvency and compatibility of coating and attacking chemical substance
- swelling and penetration
- reactivity of chemical substances
- crosslink density
- surface energy
- porosity

Fig.: Stages of degradation of a coating in chemical attack at different temperatures

High throughput experimentation of chemical resistance by gloss measurement

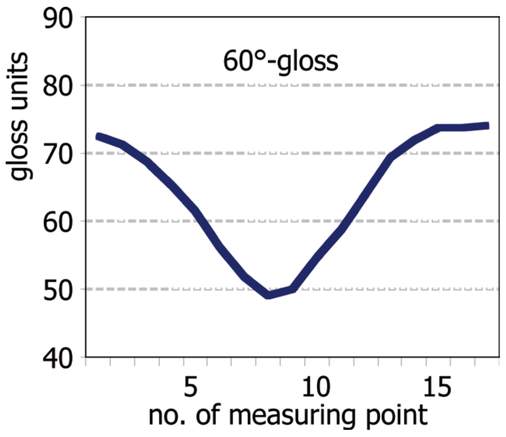


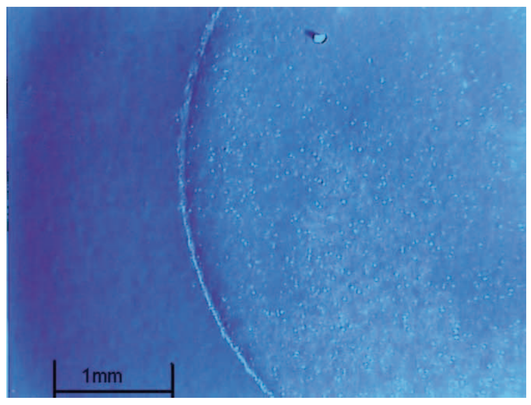
- dosing of chemicals
- identical volumes
- different volumes
- control of droplet sizes
- usage of fleeces for control of etching size

- tempering
- constant temperature
- temperature gradient
- lateral gradient oven

- linear movement of glossmeter – stepwise over etched spots

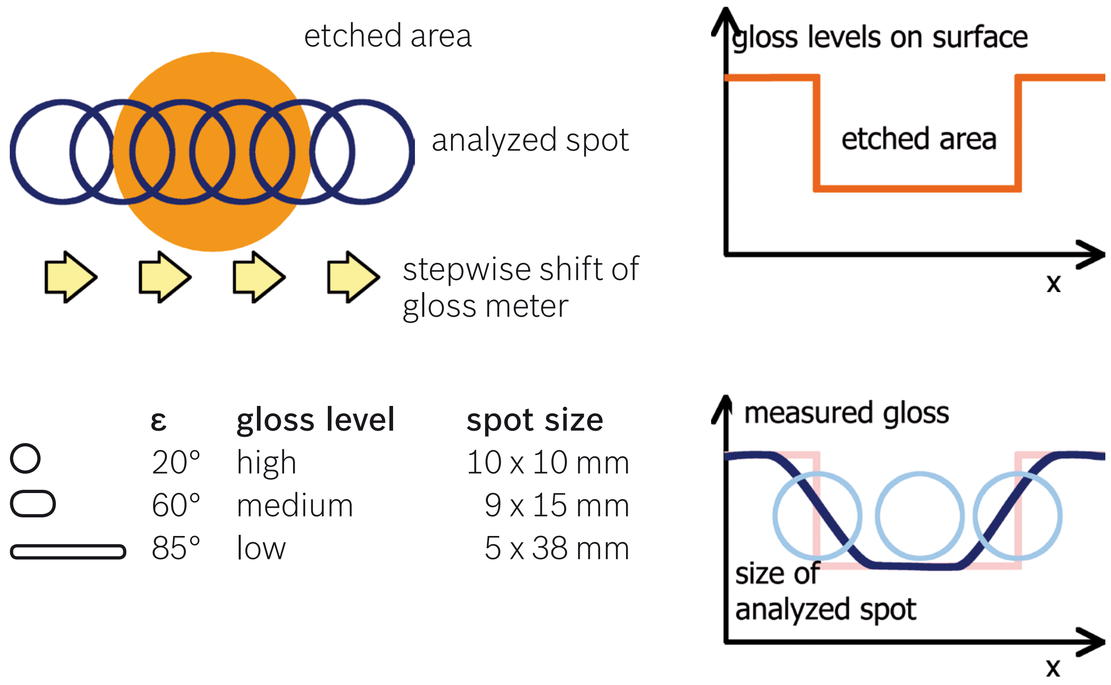
Typical damage after etching with sulfuric acid





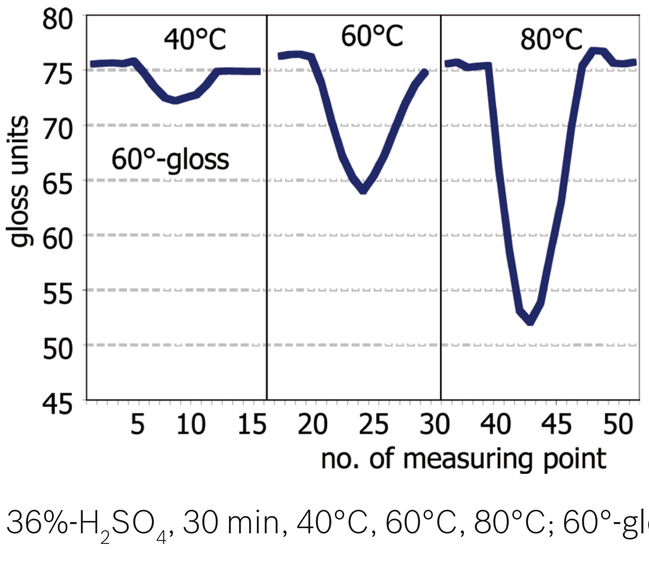
25 µl 36%-H_2SO_4, 24 h, 23°C;
gloss measurement (left), microscopic image (right)

Convolution of etched area and analyzed spot



	ε	gloss level	spot size
○	20°	high	10 x 10 mm
⬭	60°	medium	9 x 15 mm
▬	85°	low	5 x 38 mm

Etching at different temperatures



higher temperature causes stronger etching

peak area is a measure for the degree of etching

36%-H_2SO_4, 30 min, 40°C, 60°C, 80°C; 60°-gloss

Results and discussion

- chemical resistance of coatings is measureable by gloss changes (even better than by color changes [1])
- even gloss changes not visible to the naked eye are detectable using a commercial gloss meter
- a stepwise linear shift of the gloss meter over the etched spot delivers a convoluted signal. Precision of lateral dimension and magnitude of gloss level of the affected area is enhanced by using small analyzed spots and large etched areas.
- the high throughput experiment provides information on chemical resistance which gives insight into properties affecting the chemical resistance like the crosslink density

[1] S. Linder, Bachelor Thesis, Esslingen University of Applied Sciences, 2009

Contact
Robert Bosch GmbH
Bosch Lab Systems PA/PJ-BLS
Postfach 1127
71301 Waiblingen, GERMANY

Phone: +49 711 811 58001, -58008
Fax: +49 711 811 58000
boschlabsystems@bosch.com

Hochschule Esslingen
University of Applied Sciences