

Oberflächenenergien ausgewählter Stoffe

Flüssigkeiten:	mJ/m ²	Oberflächen:	mJ/m ²
- Wasser	72.6	- Teflon	18-20
- Glycerol	63.4	- Paraffin	23-25
- Hexadekan	27.6	- PE	30-31
- Oktan	21.8	- PS	33-35
		- PVC	39
		- Cu	44
		- Gold	57.4
		- Glas (Soda)	47
		- Glas (Pyrex)	170

(teilweise stark abhängig von chemischer Vorbehandlung)

Benetzungsszenarios

Kontaktwinkel:

Θ 0°

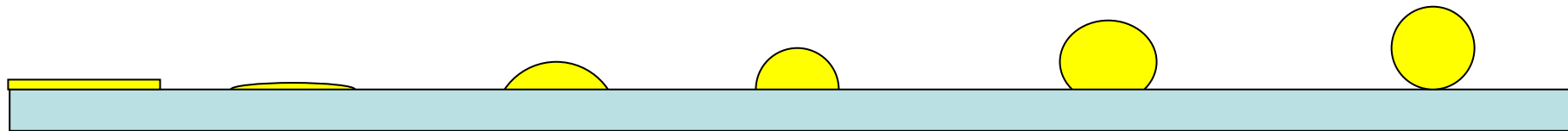
90°

180°

$\cos \Theta$ 1

0

-1

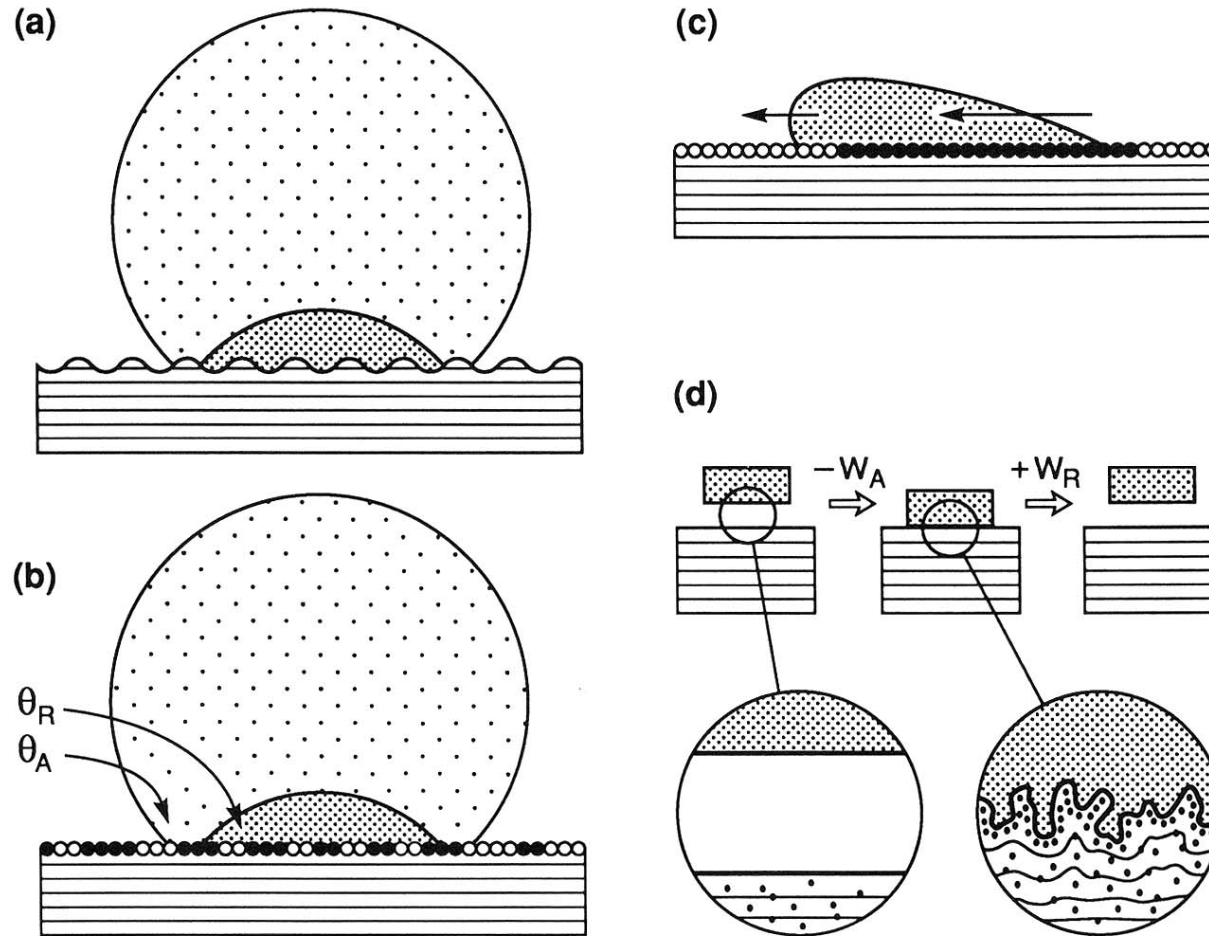


Vollständige
Benetzung

Partielle
Benetzung

Nicht
benetzend

Kontaktwinkelhysterese



Aus: J. Israelachvili: Intermolecular and Surface Forces

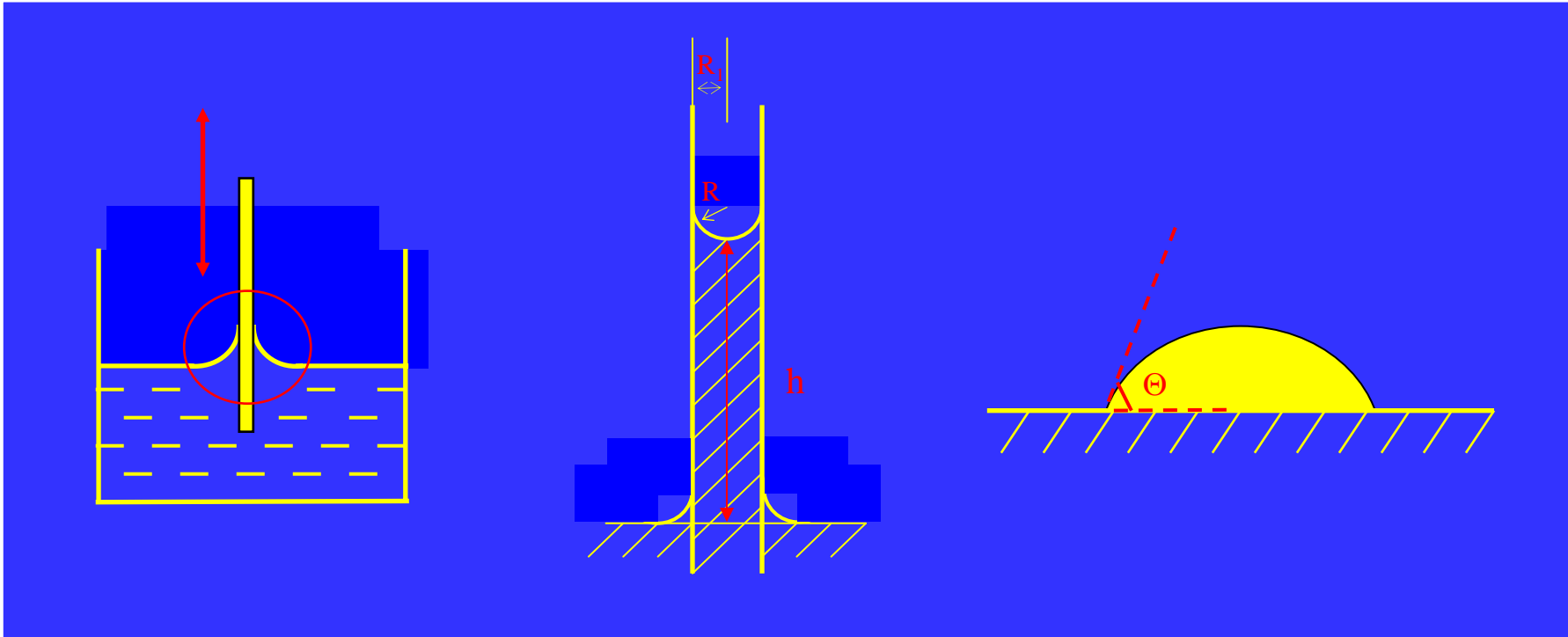
Kontaktwinkelhysteresis

Wassertropfen auf hydrophobisierter Si-Oberfläche
(Echtzeit ca. 20 min)



(Experiment von H. Graaf)

Geometrien zur Messung von Kontaktwinkeln

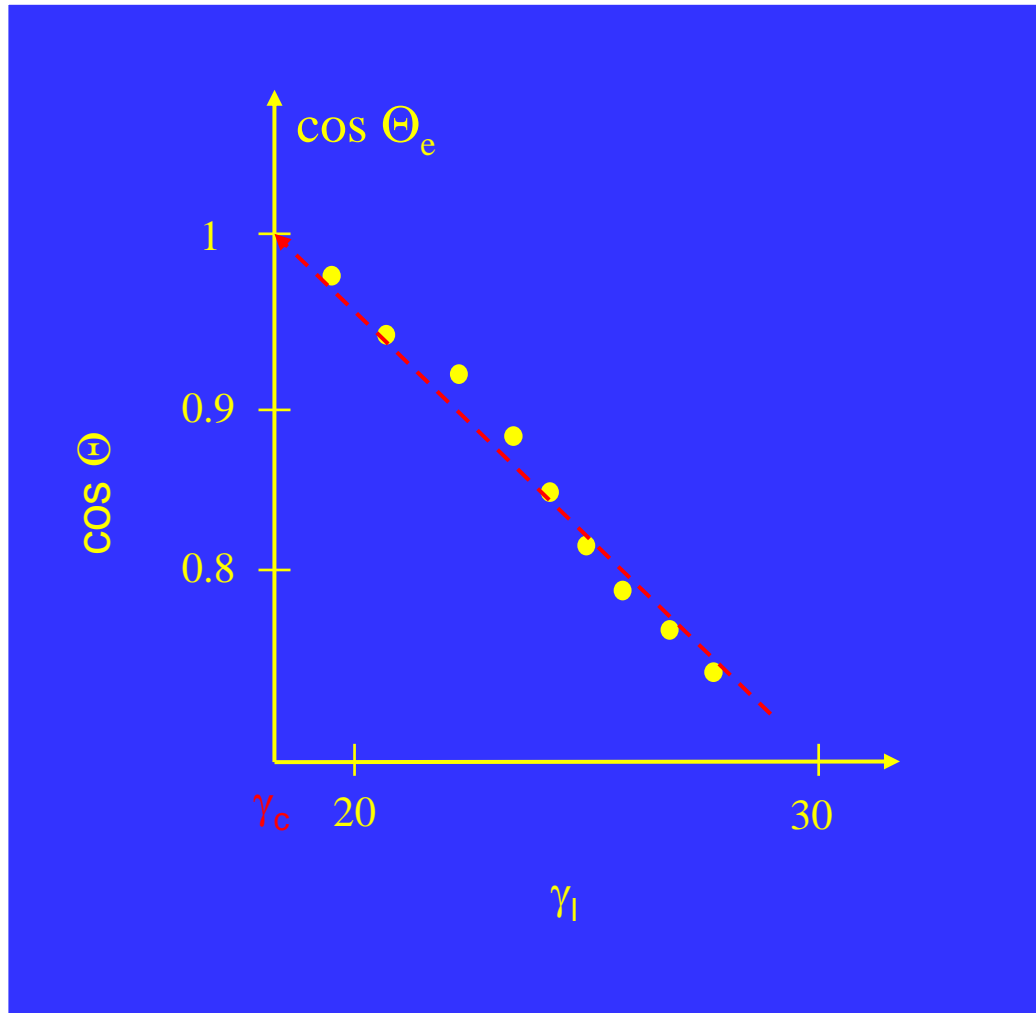


Substrat
(Wilhelmi Slide)

Kapillare
(Capillary Rise)

Tropfen
(Sessile Drop)

Zisman Plot

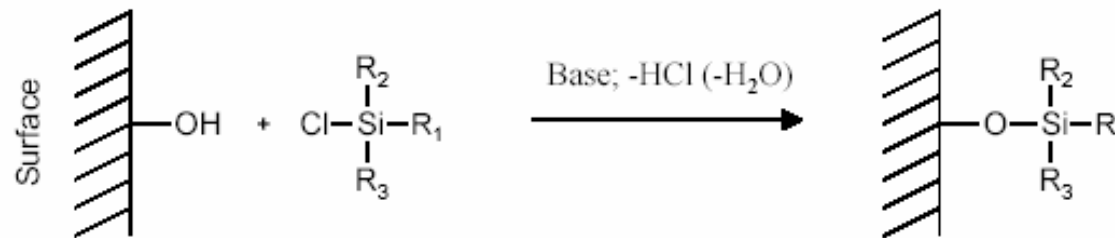
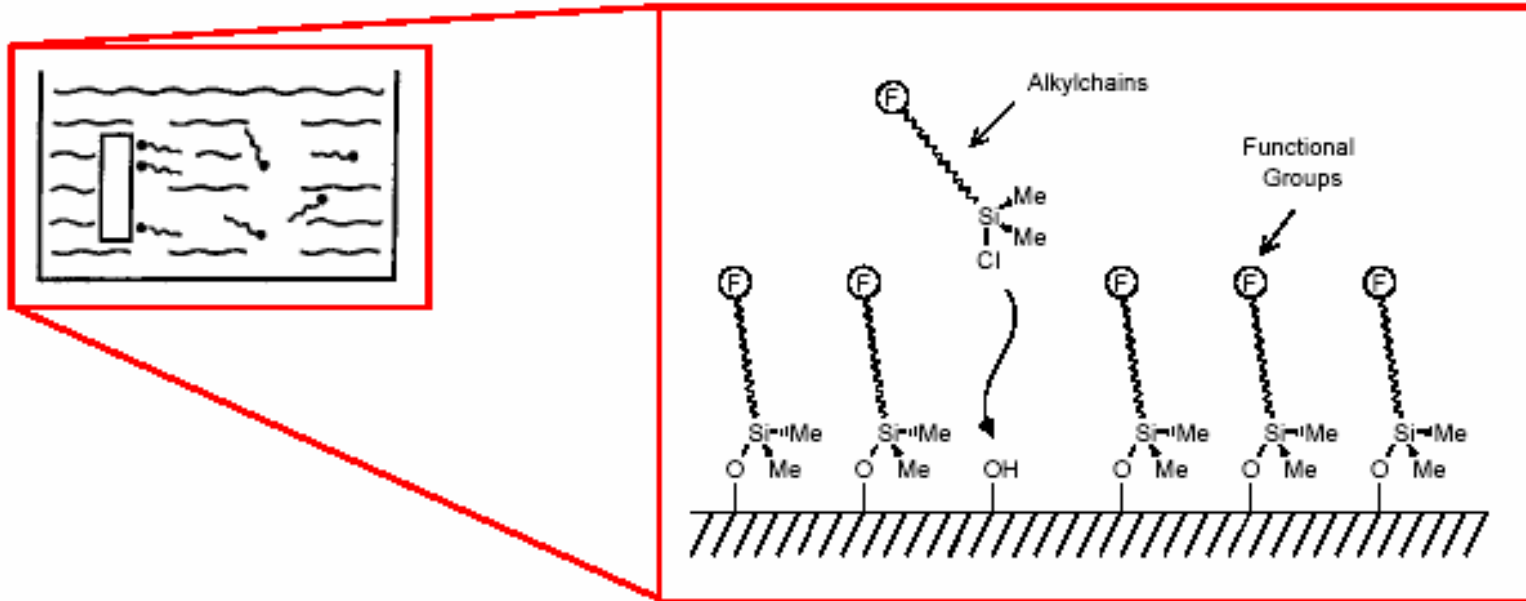


Serie homologer Flüssigkeiten
mit variablem γ_l

Extrapolation auf $\cos(\Theta)=1$

γ_c ist Oberflächenspannung
einer Flüssigkeit, die Oberfläche
gerade benetzt
(ist nicht γ_s)

Self assembled monolayers (SAM)

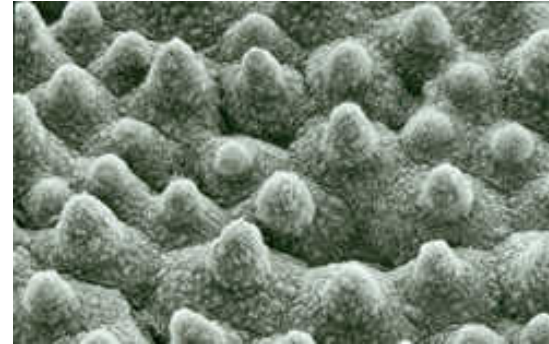


z.B. Silane, Thiole oder Ähnliches,
Variable Oberflächenenergie durch verschiedene funktionelle Gruppen

Lotuseffekt



Wassertropfen auf Lotus



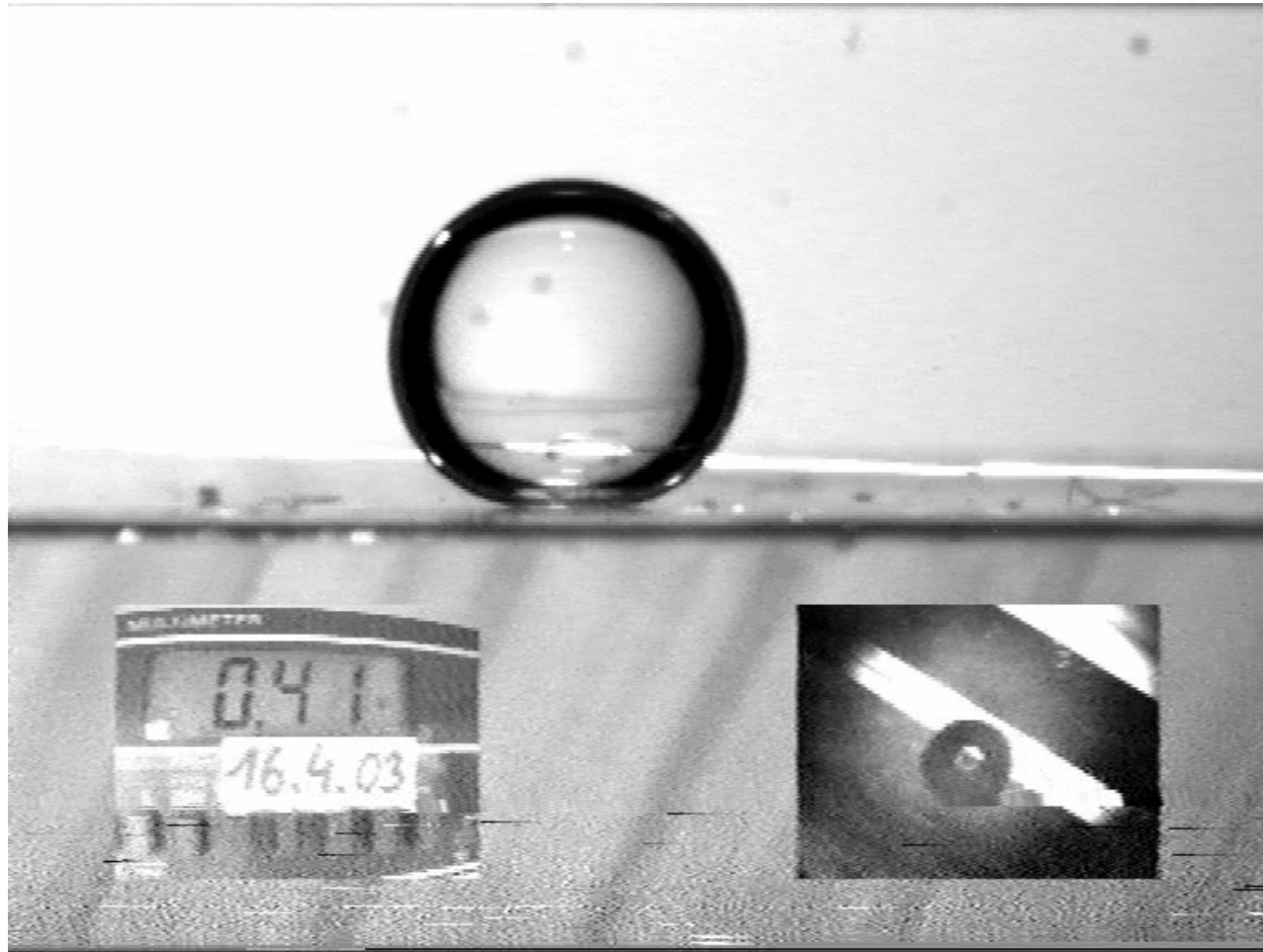
Mikrostruktur (20 μm)



Funktion der Oberfläche



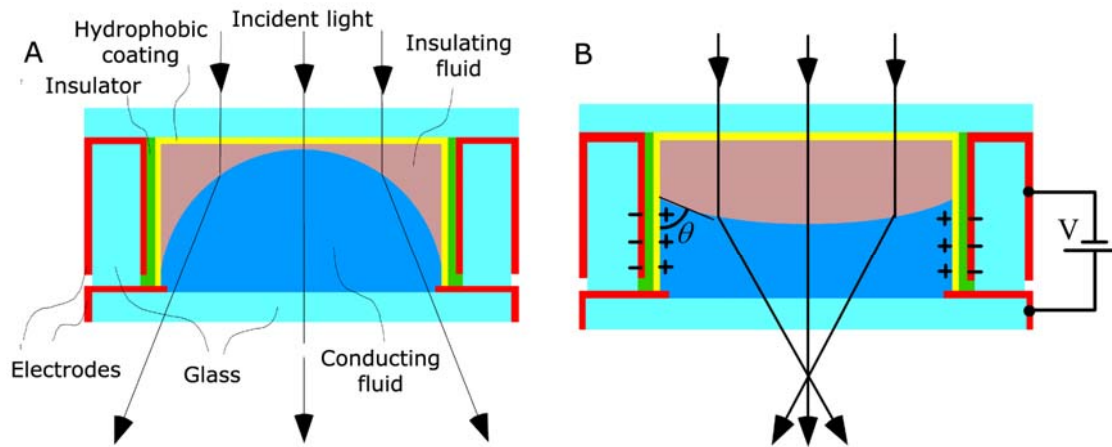
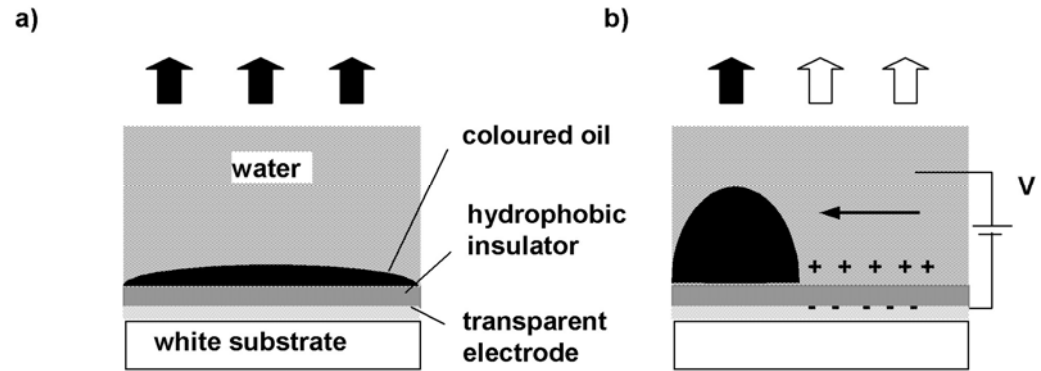
Electrowetting



(F. Mugele, Uni Ulm)

Electrowetting – Anwendungen

Display

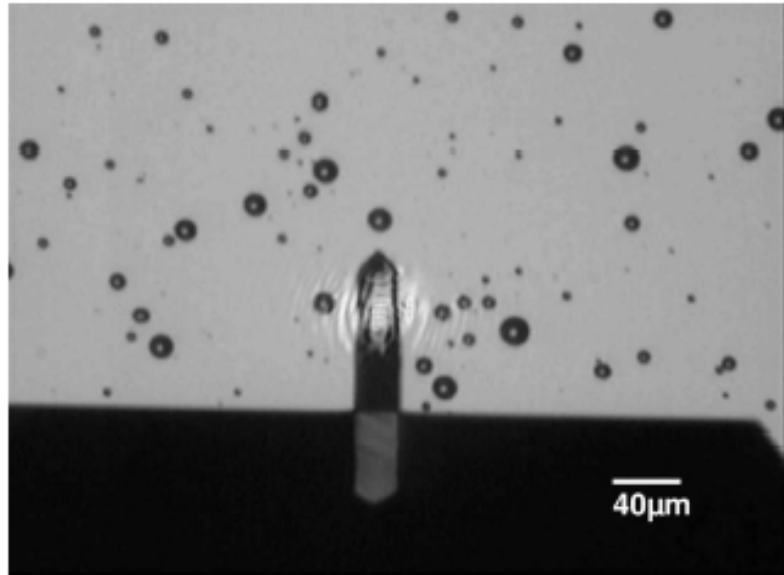


FluidFocus

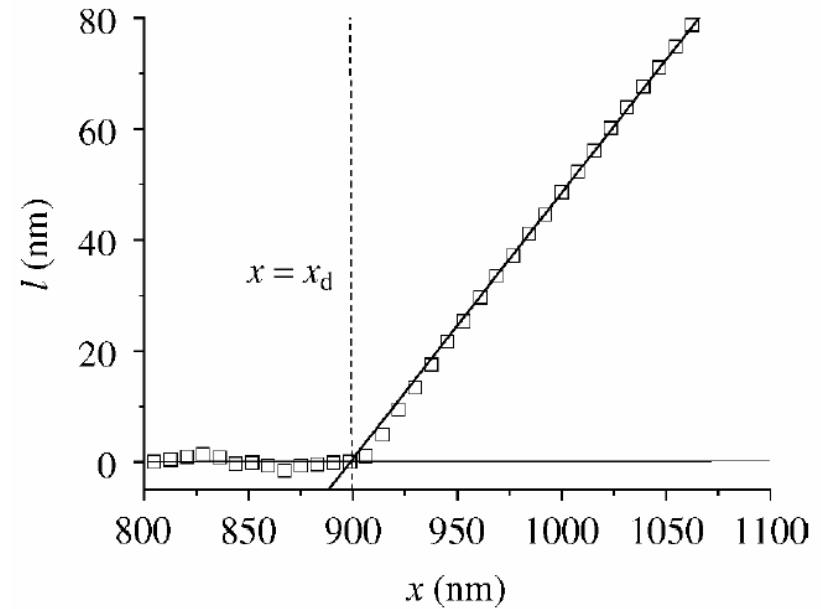


Philips Research
www.research.philips.com

Messung der Kontaktlinienspannung



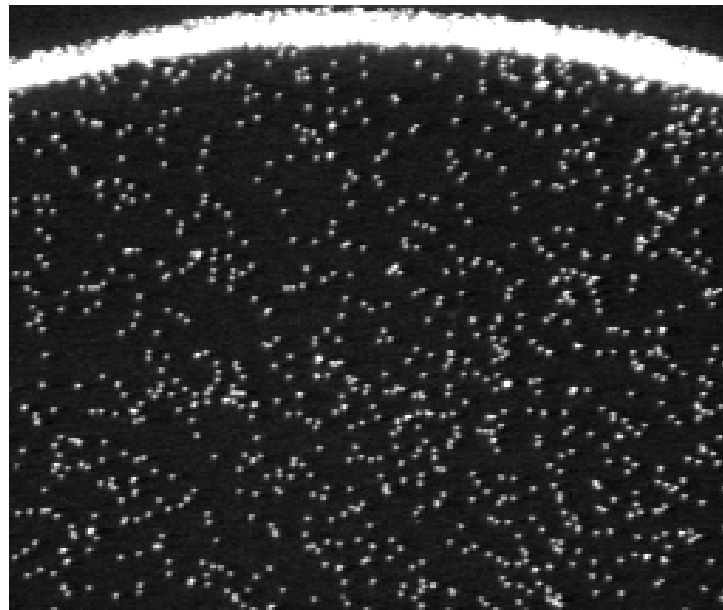
AFM-Spitze und kleine Tröpfchen



Tropfenprofil, Abweichungen von Kugelform am Tropfenrand

Der Kaffeefleckeneffekt

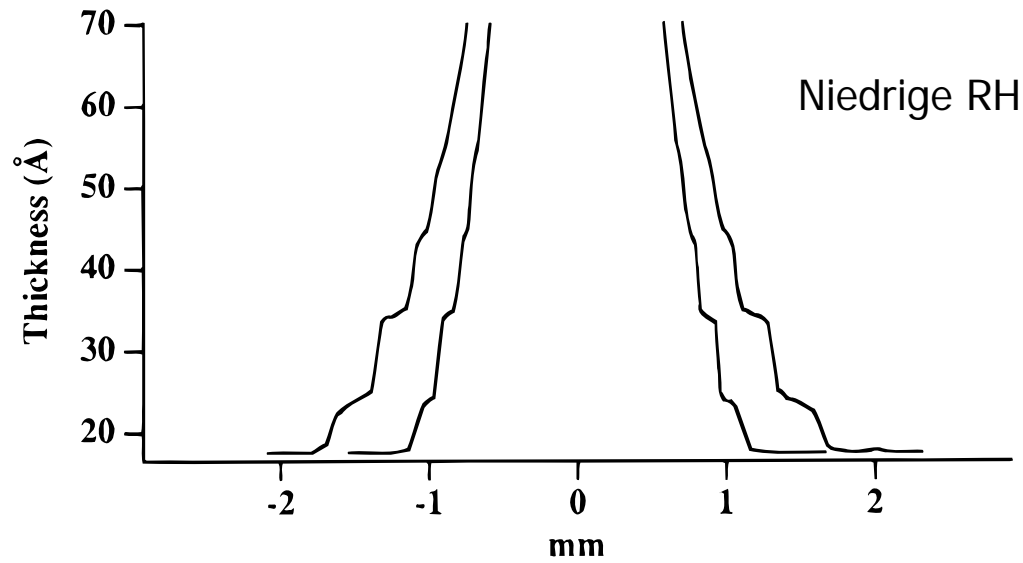
Materialtransport zum Tropfenrand



T. A. Witten, U Chicago

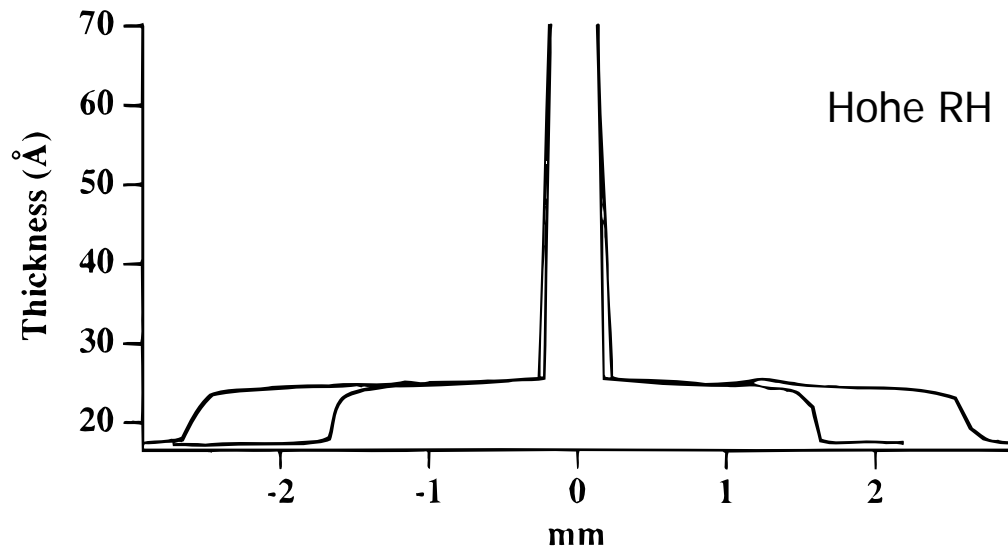
mrsec.uchicago.edu/Nuggets/Coffee/

Ausbildung eines Precursorfilms



TEHOS auf Si,
ortsaufgelöste
Ellipsometrie

(Vilette et al., Langmuir 12,
1996, 825)



Kontaktlinieninstabilität - Viscous Fingering

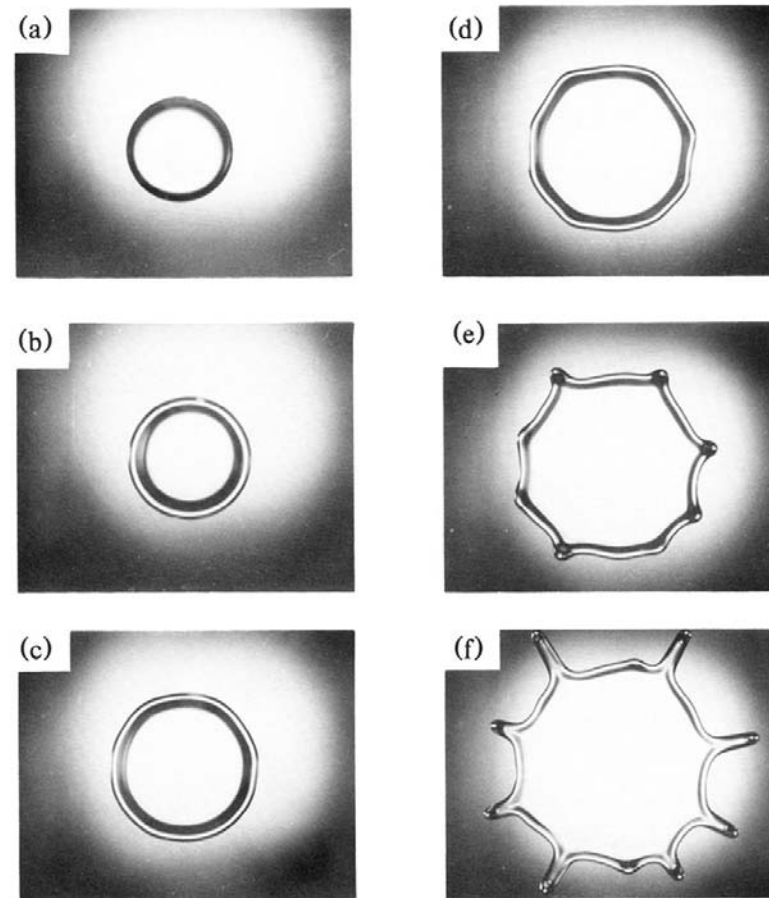


FIG. 1. The different stages of spreading of a spinning drop. The black zones correspond to the nonzero-slope regions of the liquid film. (a) Initial conditions; a volume of $50 \mu\text{l}$ of silicon oil (viscosity $50 \text{ cm}^2/\text{s}$) is released on the substrate, rotating at a frequency $f=10 \text{ Hz}$. (b) After 30 s; formation of a bump, visualized by the bright annulus, in the vicinity of the contact line. (c) After 140 s; the wavy modulation of the rim at the early stage of instability. (d) After 180 s; development of the wavy perturbation. (e) After 220 s; break up into fingers. (f) After 310 s; well developed fingering.

Melo et al., PRL 63, 1989, 1958

Entnetzung - Szenarien

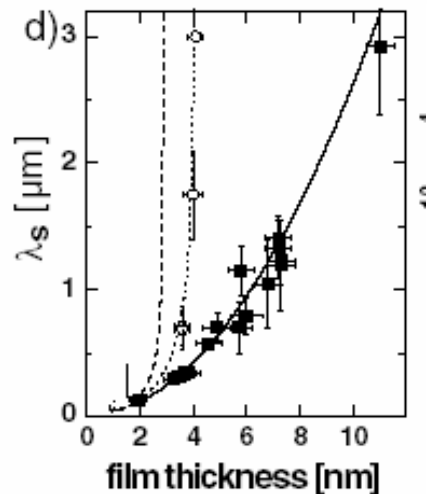
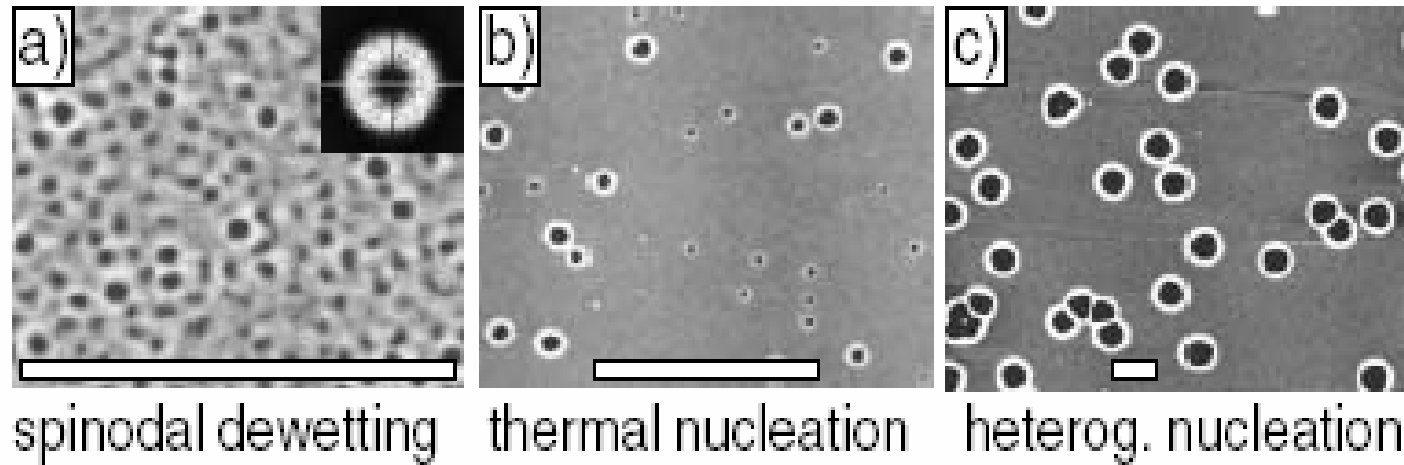
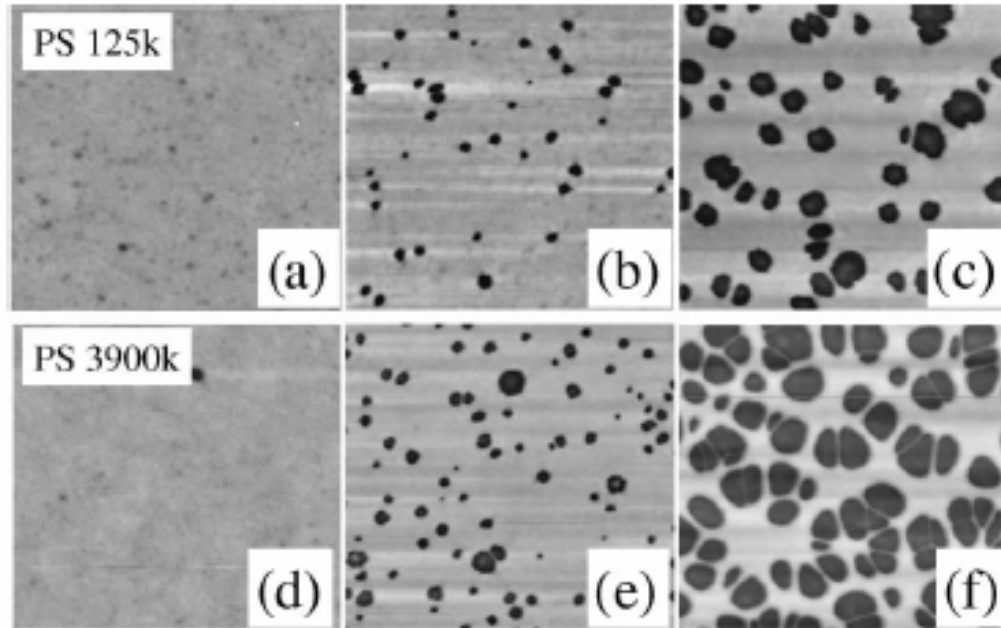


FIG. 2. (a)–(c) AFM images of dewetting PS(2k) films. Scale bars indicate $5 \mu\text{m}$, z -scale ranges from 0 (black) to 20 (white) nm: (a) 3.9 nm PS on type C wafer. The inset shows a Fourier transform of the image. (b) 4.1 nm PS on type B wafer. (c) 6.6 nm PS on a type B wafer. (d) Spinodal wavelength λ_s as a function of PS film thickness h on type B (open circles) and type C wafers (filled squares). (e) Second derivative of effective interface potential ϕ'' as a function of film thickness h .

Stadien der Entnetzung



G. Reiter, PRL 87, 2001, 186101

Herminghaus et al., Nachr. a. d. Chemie 49,
2001, 1398

