

### Task

#### Inks and glues adhere only on clean and wettable surfaces

Surface energy is a measure of wettability.

#### Test with test inks (DIN 53 364)



**32 mN/m: spreading**  
→ surface energy higher than 32 mN/m

**34 mN/m: wetting (rim)**  
→ surface energy not less than 34 mN/m

**35 mN/m: no wetting**  
→ surface energy below 35 mN/m

**Result: surface energy of probe is 34 mN/m**

#### Measurement of surface energy is necessary

- before printing: solvent-based inks need 38 mN/m  
water-based inks need 45 mN/m
- before gluing: at least 43 mN/m
- as a process control after a pre-treatment
- as a process control after cleaning

### Hints and quantities of delivery

#### Surface energy of solids

		[dyn/cm = mN/m]
Polycarbonate	PC	46,0
Polydimethylsiloxane		14,1
Polyethylene	LDPE	31,0
Polyethylene	HDPE	33,0
Polyethylenterephthalate	PET	43,0
Polyoxymethylene	POM	38,0
Polypropylene	PP	32,0
Polystyrol	PS	33,0
Polytetrafluorethylene	PTFE	18,0
Polyvinylchloride	PVC	39,0
Metals, metal oxides		> 100
Iron	Fe	2550

The values depend very sensible on the purity and cleanliness of the surface. Additives, especially gliding agents and pigments can modify the values very strongly in technical materials. Water layers may mask metal surfaces and simulate a low surface energy.

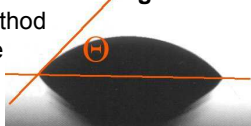
#### Alternative measuring methods

##### Test pens

- Easy to handle
- Not safe due to risk of contamination

##### Measurement of contact angle

- Laboratory method
- Polarity can be calculated



#### Test inks

##### Series A: Formamide-Ethylenglycol following DIN ISO 8296, series A and ASTM D 2578-99a, blue from 30 to 58 mN/m

- Standard test inks
- For PE, PP and similar
- Not for PU and PVC (soft)
- Poisonous

##### Series B: Methanole-Water-mixture following DIN 53 364, series B and DIN ISO 8296, light red from 23 to 72 mN/m

- Suitable for PVC (soft)
- 23, 25, 27, 30, ...(+2)... 46 mN/m: poisonous
- 48 - 64 mN/m: harmful

##### Series C: Ethanol-Water-mixture, light red from 30 to 72 mN/m

- Harmless for health
- Not suitable for any application

##### Series E: Alkane-series

- 16, 18, 20, 25 mN/m
- Polarity = 0, transparent

##### Series F: Water-table salt-mixture

- 77 and 82 mN/m
- Harmless for health

#### Important note

Do not compare surface energies obtained with different methods or different series of test inks!

### Standards for assessment of the wettability

#### DIN 53 364 (4-1986) Wettability of films

Average wettability of PE-, PP- and PVC-films with the rim of brush strokes a series of test inks.

- Commonly used and simple in application
- High reproducibility  $\pm 0.5$  mN/m (dyn/cm)

Main sources of trouble:

- Application to unsuitable plastics
  - Interpretation of inhomogenities
- Followed by DIN ISO 8296, but nevertheless in common use.*

#### DIN ISO 8296 (9-2003) and ASTM D 2578-99a (2004)

Minimum wettability of film with two-dimensional application of test inks.

- Difficult application of test inks
- Low reproducibility  $\pm 2$  mN/m (dyn/cm)

Main sources of trouble:

- Needs homogeneous thickness of ink layer
- Introduction of water with cotton sticklets

#### AFCO-Recommendation C (1980)

Wettability of Aluminium-Foils from the drain off of Water/Ethanol-mixtures from inclined samples.

- Advantageous if the ink reacts chemically with the substrate.

**We measure for you! Send us your samples.**

#### Quantities of delivery

- 30 ml bottle, with brush or pipette
- 100, 500 und 1000 ml, supply bottle

#### Standard sets for your application

##### 19001:

Set for metals (Series A + E)  
4x30 ml: 20, 30, 38, 46 mN/m

##### 19002:

Set for plastics (Series A)  
4x30 ml: 34, 38, 44, 46 mN/m

##### 19003:

Additional set (Series A)  
4x30 ml: 30, 40, 52, 58 mN/m



**We recommend our corona and APP-stations to increase the surface energy of your substrates.**