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**COLORS** ●●●●  
**FOR SUCCESS**

**Hidden Design of Ambient Lighting & its Printing Solutions**

## Proell Information:

- Family owned company, since 1938
- About 150 employees
- 3 subsidiaries & 1 production base at Germany HQ
- Leading FIM/IMD ink manufacturer



## Proell - Worldwide



Proell KG Headquarters Weißenburg, Germany



Proell, Inc. St. Charles, IL, USA



Proell Ink Trading Shanghai Co., Ltd., PR China

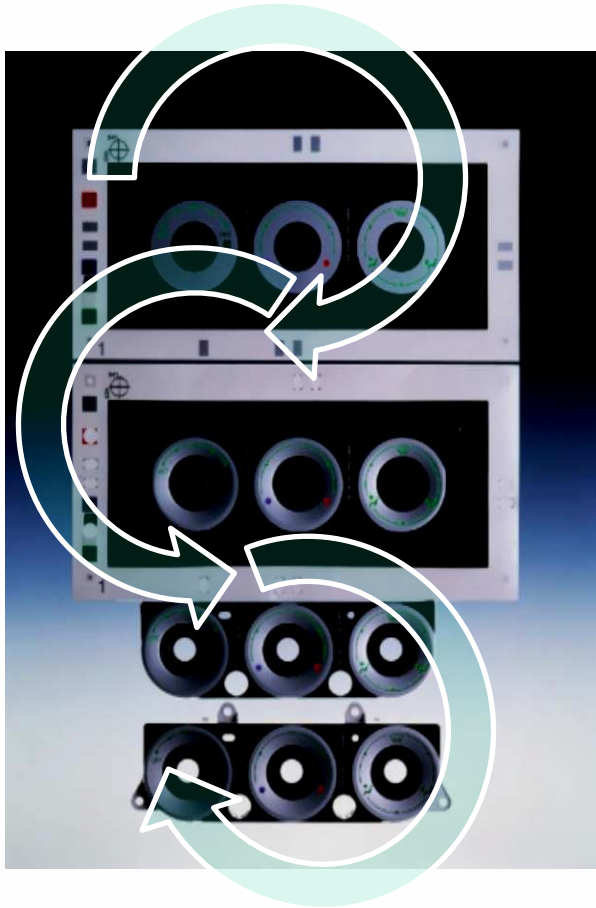
## Core Competences : R + D center



## Core Competences: Screen Printing Facility



## IMD/FIM Process



Screen Printing

NORIPHAN® HTR N

Norilux® DC

Drying

Forming

UV-Curing

Cutting

Injection  
Molding

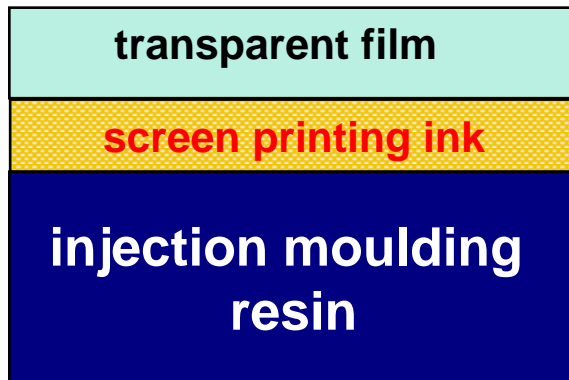
Past times



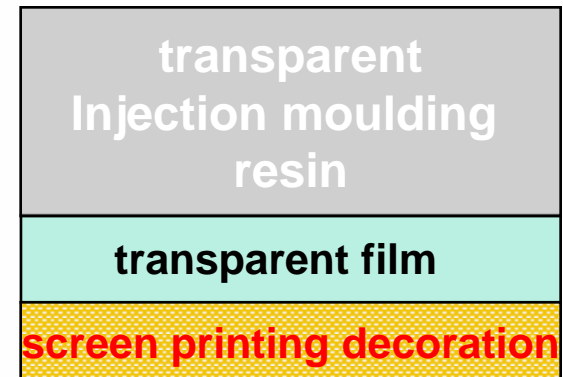
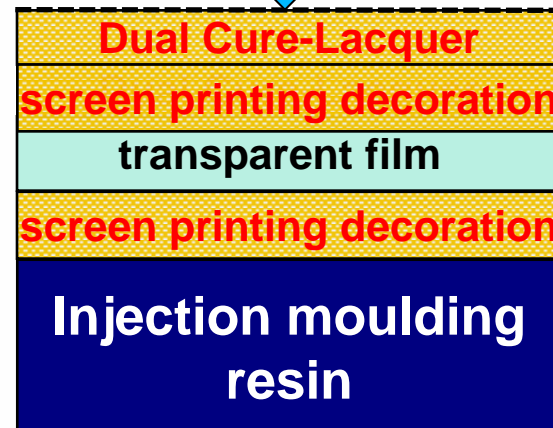
Today's routine

## Different IMD/FIM structure:

Look, touch, feel  
variabilities

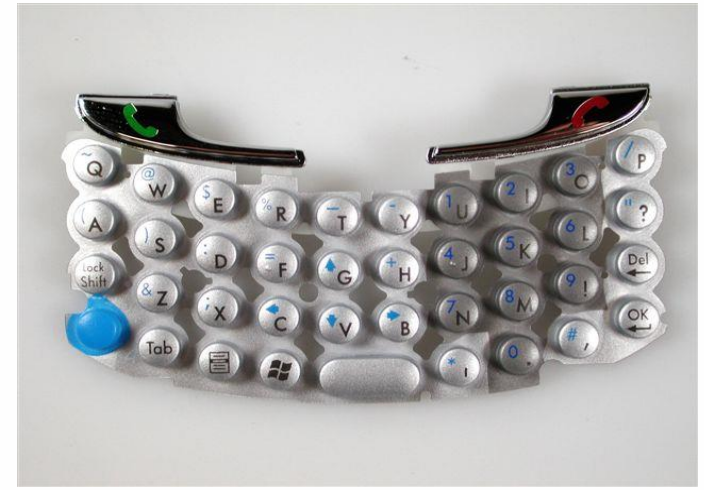


Back molding



Over molding

## Application example





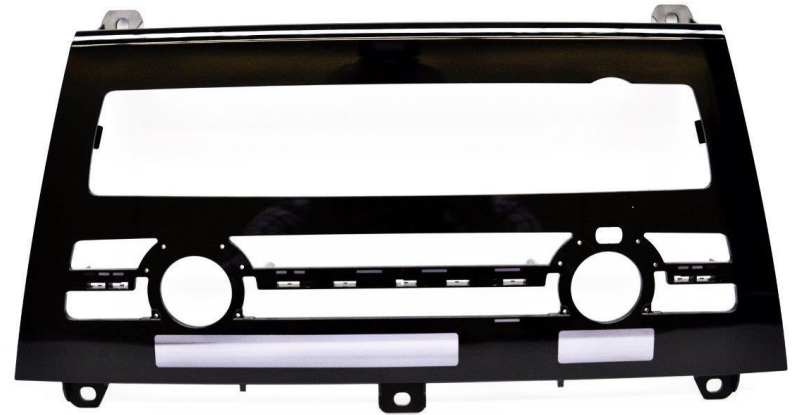
## Application example



## Application example



## Application example



## Application example



## Application example



Lincoln MKZ

Makrofol® HF278 G-4 265µm  
large area w/ matte  
Norilux DC coating  
by Proell

- capacitive touch slider
- black panel design

preh

NewAlbea KUNSTSTOFF  
TECHNIK  
Innovation für Fortschritt



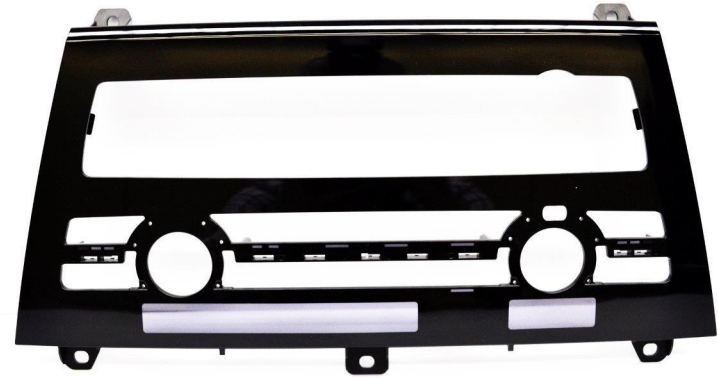
[http://www.automationalley.com/ia2\\_news\\_newsdetail?id=a0M6000000D4AGdEAN](http://www.automationalley.com/ia2_news_newsdetail?id=a0M6000000D4AGdEAN)



## Application example



## Application example

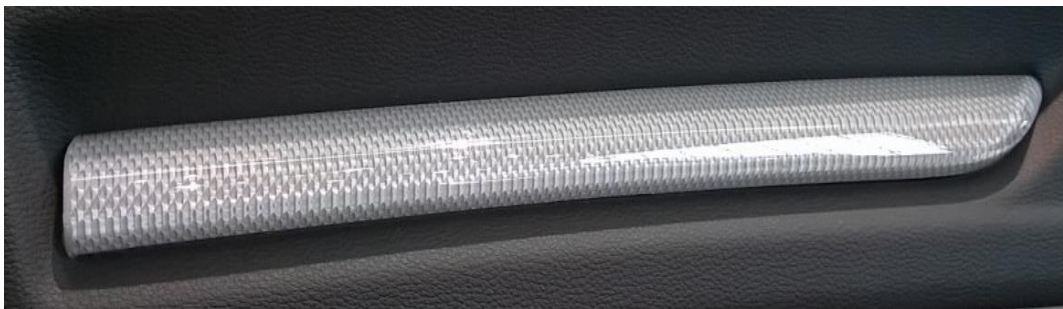


## Application example





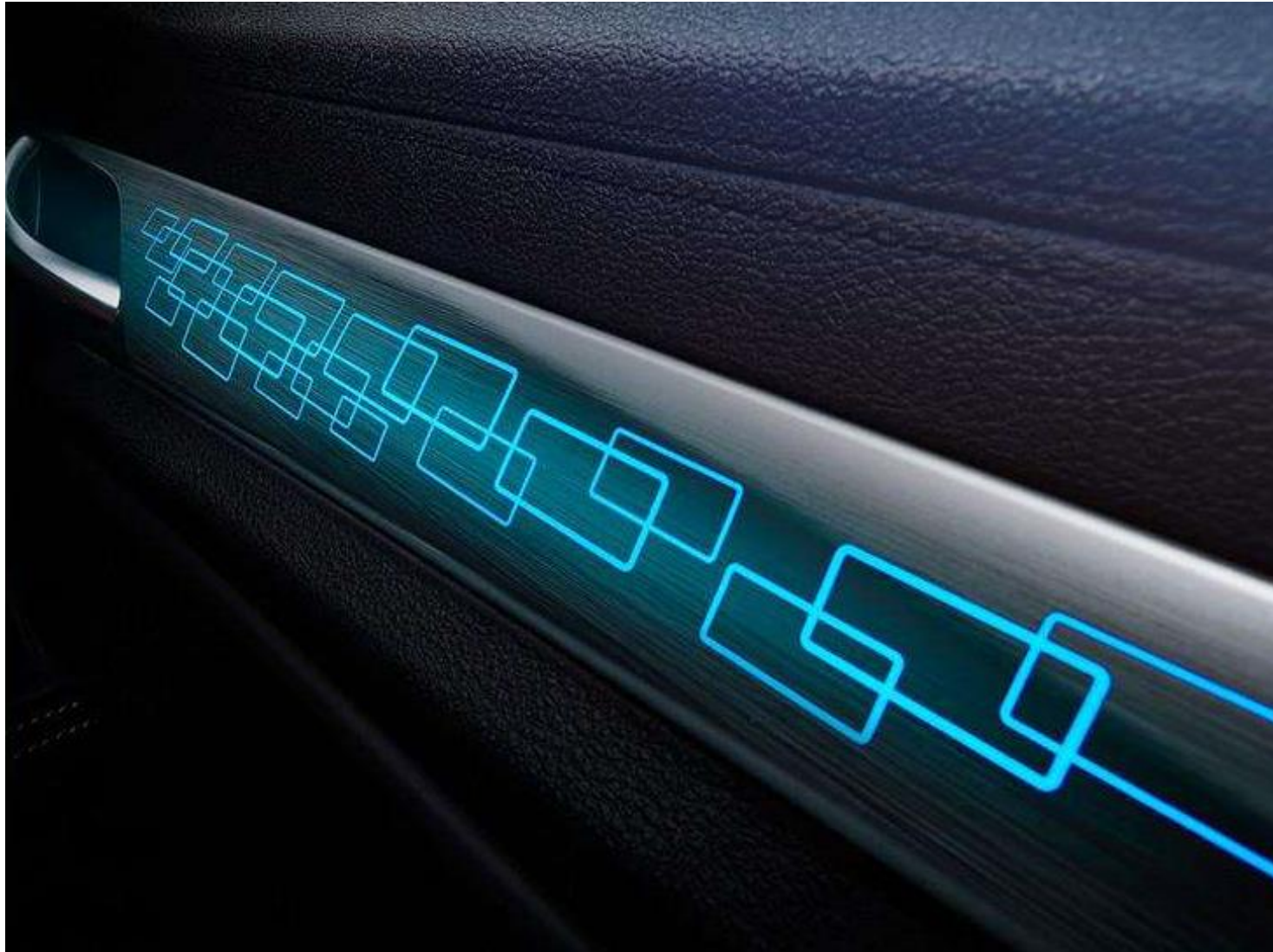
## Application example



# Hidden Design of Ambient Lighting

## Role of Ambient lighting:

- ❖ Changing the appearance of interior in the night, endue night recognition among different brands.
- ❖ Light range & color show more features, luxurious, warm, sport, scientific
- ❖ Highlight car character lines, make interior look more stereoscopic, amplify car space visually
  
- ❖ **Summation:**
  - ✓ **A little illumination function**
  - ✓ **decoration > practicability**



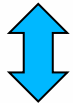




## Type of ambient lighting

**Direct lighting** through light-guiding materials, such as:

- ✓ instrument profile
- ✓ cup holder profile
- ✓ toplight profile
- ✓ switch/knob profile
- ✓ panel trims
- ✓ .....



**No printing**

**Indirect lighting** through reflection or refraction of lighted interface, such as:

- ✓ dashboard
- ✓ Door trims
- ✓ panels
- ✓ .....



**hidden Design** by Printing inks ✓

By ourselves?

Or

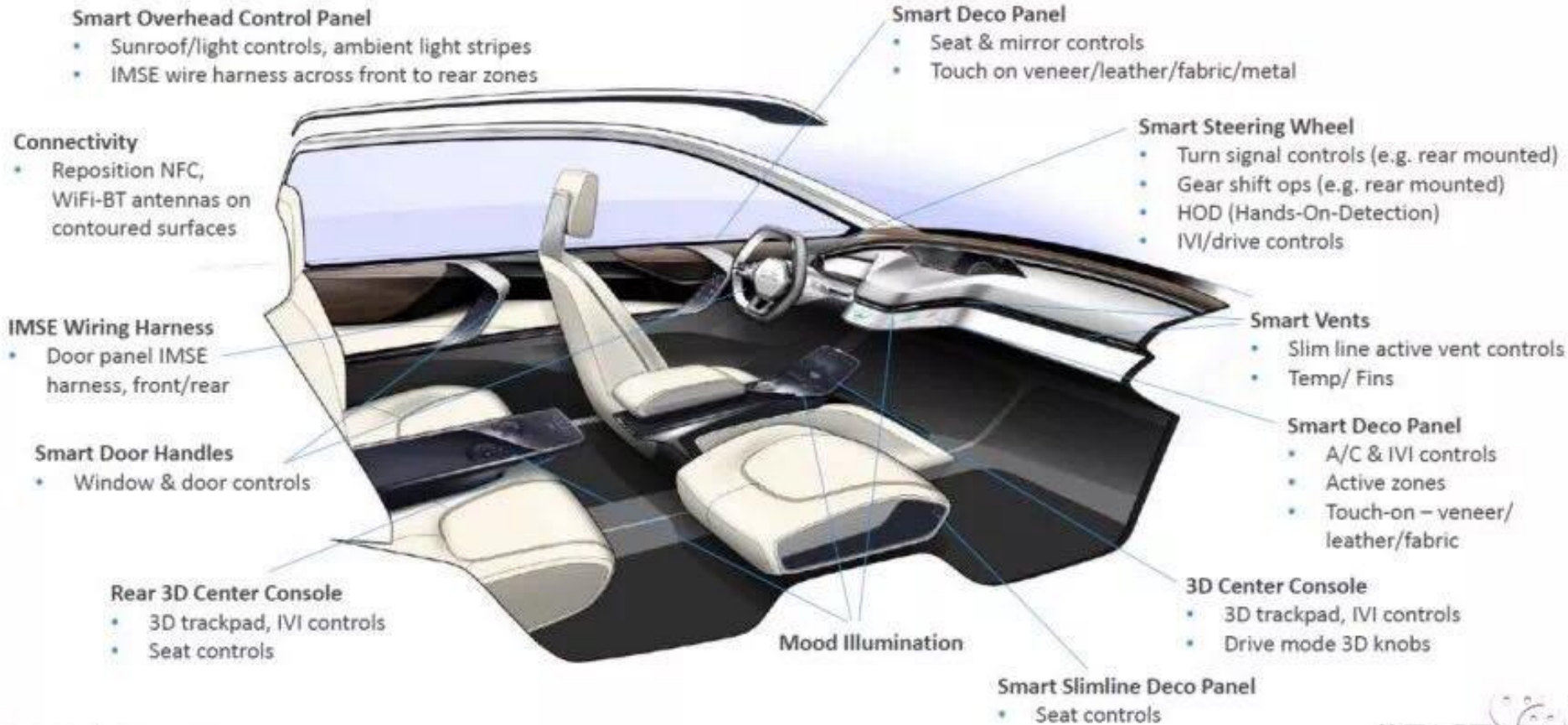
By supplier?





# Smart Surface protection

## » 10s of Interior Use Cases



Appearance, texture, effect, ambient lighting, backlit, touch, protection, anti-bacteria

## Ink role on smart surface?



- ✓ Realization of all kinds of appearances, effects, capacitive function
- ✓ Ambient lighting & Backlit design
- ✓ Parts integration (FIM or lamination)
- ✓ Smart surface protective

## Parts integration by Proell FIM/IMD inks

Resin / Film	PC	PC Blends	ABS	SAN	PMMA	TPU	Silicone Rubber	PA	PS	PP
PC	<b>Decoration layer:</b> HTR N or N2K or PCI N or XWR, XMR  <b>Adhesive optionally:</b> CA HT or LT or HTR N 093 or N2K 093 or SMK	Decoration layer: HTR N or N2K or PCI N or XWR  Adhesive optionally: CA HT or LT or HTR N 093 or N2K 093 or SMK	Decoration layer: HTR N or N2K or PCI N or XWR  Adhesive necessary: CA HT or LT or SMK	Decoration layer: HTR N or N2K or PCI N or XWR  Adhesive necessary: NorIPET® 093 or Noricryl® 093	Decoration layer: HTR N* or PCI N* or XWR  Adhesive optionally: CA HT or LT or HTR N 093 +051 or 051* or Noricryl® 093	Decoration layer: HTR N or PCI N or XWR  XWR needs adhesive layer: HTR N 093	Decoration layer: HTR N or N2K or PCI N or XWR  XWR need adhesive layer: HTR N 093	Decoration layer: HTR N or N2K or PCI N or XWR  Adhesive necessary: SMK or APM		HTR, XWR  Adhesive layer: PPX
PC Blend	Decoration layer: HTR N or N2K or PCI N or XWR  Adhesive optionally: CA HT or LT or HTR N 093 or N2K 093 or SMK	Decoration layer: HTR N or N2K or PCI N or XWR  Adhesive optionally: CA HT or LT or HTR N 093 or N2K 093 or SMK	Decoration layer: HTR N, N2K, PCI N or XWR  Adhesive necessary: CA HT or LT or SMK or NorIPET® 093 or Noricryl® 093	Decoration layer: HTR N, N2K, PCI N or XWR  Adhesive necessary: NorIPET® 093 or Noricryl® 093	Decoration layer: HTR N* or PCI N* or XWR  Adhesive optionally: CA HT or LT or HTR N 093 +051 or 051* or Noricryl® 093 or SMK	Decoration layer: HTR N or PCI N or XWR  XWR needs adhesive layer: HTR N 093	Decoration layer: HTR N or N2K or PCI N or XWR	Decoration layer: HTR N or N2K or PCI N or XWR  Adhesive necessary: SMK or APM		HTR, XWR  Adhesive layer: PPX
PET	Decoration layer: N2K or XWR  Adhesive optionally: CA HT or LT or N2K 093 or HTR N 093 or SMK	Decoration layer: N2K or XWR  Adhesive optionally: CA HT or LT or N2K 093 or HTR N 093 or SMK	Decoration layer: NorIPET® N2K or XWR  Adhesive optionally: CA HT or LT or NorIPET® 093 or SMK	Decoration layer: NorIPET® N2K or XWR  Adhesive optionally: NorIPET® 093	Decoration layer: NorIPET® or N2K or XWR  Adhesive necessary: CA HT or LT or HTR N 093 +051 or 051* or Noricryl® 093 or SMK	Decoration layer: NorIPET® or N2K or XWR  Adhesive necessary: CA HT or LT or HTR N 093 or SMK	Decoration layer: NorIPET®, N2K or XWR  Adhesive optionally: HTR N 093 or N2K 093 or SMK	Decoration layer: N2K or NorIPET® or XWR  Adhesive necessary: SMK or APM		N2K, XWR  Adhesive layer: PPX
PMMA	Decoration layer: HTR N or PCI N Noricryl® (adhesives)  Adhesive optionally: HTR N 093 or CA HT or LT or SMK	Decoration layer: HTR N or PCI N  Adhesive optionally: CA HT or LT or HTR N 093 or N2K 093 or SMK	Decoration layer: HTR N or PCI N or Noricryl®  Adhesive optionally: CA HT or LT or NorIPET® or Noricryl® or SMK	Decoration layer: HTR N or PCI N or Noricryl®  Adhesive optionally: NorIPET® 093 or Noricryl® 093	Decoration layer: HTR N* or PCI N* or Noricryl®  Adhesive optionally: CA HT or LT or HTR N 093 +051 or 051* or Noricryl® 093 or SMK	-	-	Decoration layer: HTR N or PCI N Noricryl® Adhesive necessary: SMK or APM		HTR N, Adhesive layer: PPX
TPU					-	N2K	N2K	-		
PA	NoriAmid®	NoriAmid®	NoriAmid®	NoriAmid®	NoriAmid®			NoriAmid® Adhesive: SMK or APM		
PP *corona								-		Decoration ink: XWR  Adhesive : PPX
AI	Adhesive layer: SMK	Adhesive layer: SMK	Adhesive layer: SMK	Adhesive layer: SMK	Adhesive layer: SMK	Adhesive layer: SMK	Adhesive layer: SMK	SMK		
Pd									L56400 L56401	
Glass	TPI, SMK	TPI, SMK	TPI, SMK		TPI, SMK	-	-	TPI, SMK	-	

Note: \*: Resin temperature ≥ 260 °C

## Typical IMD/FIM inks

**NORIPHAN<sup>®</sup>**  
**HTR N**

Industry  
benchmark

High Tg polymer

Hard

thermoplastic

**NORIPHAN<sup>®</sup>**  
**N<sub>2</sub>K**

Supplement  
for thin films

Medim high Tg  
polymer

Medium hard

**NORIPHAN<sup>®</sup>**  
**XMR/XWR**

Supplement for  
capacitive electr. &  
higher cohesion

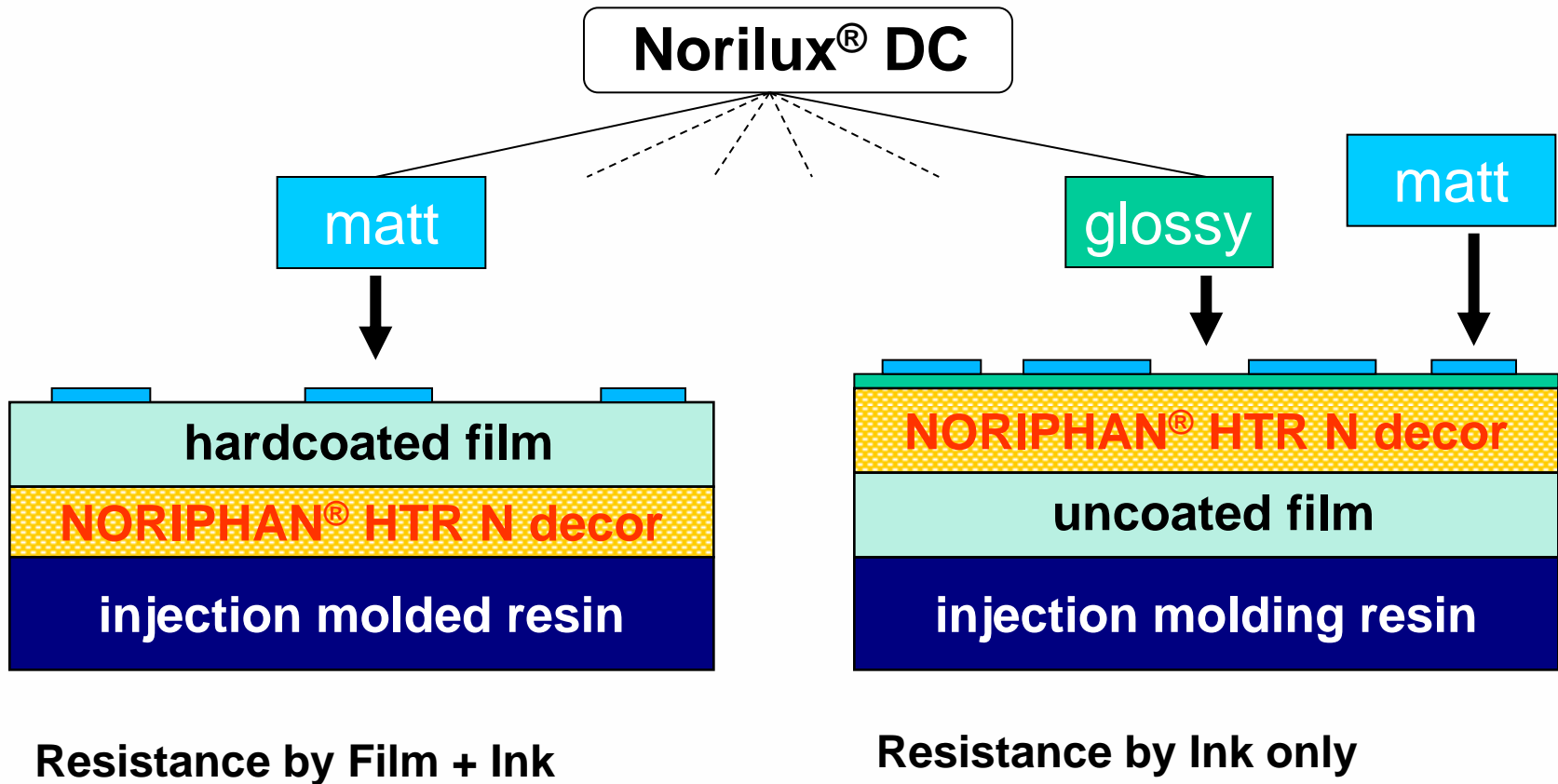
Low Tg polymer

Soft

elastomeric



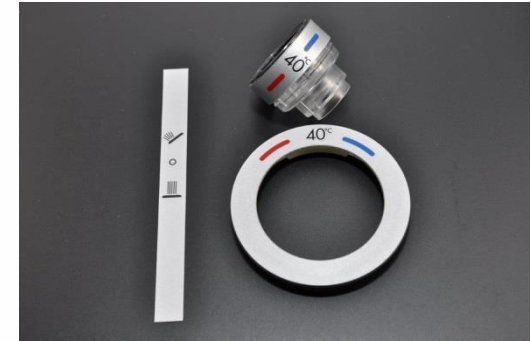
# Smart surface protection with Norilux DC



## Smart surface protection with Norilux DC

### Printing Substrates for Dual-Cure lacquers

- PC film (e.g. Makrofol<sup>®</sup>, Bayfol<sup>®</sup>)
- uncured hard coat film Makrofol<sup>®</sup> HF 312 XtraForm<sup>™</sup> M HCL 250
- PMMA film (e.g. PLEXIGLAS<sup>®</sup>)
- ABS film (e.g. Bayfol<sup>®</sup> DF-A)
- PP film
- overprinting of silicone-free layers (e.g. Pröll IMD/FIM ink systems, such as NORIPHAN<sup>®</sup> HTR N)
- Aluminum



## Smart surface protection with Norilux DC

### Excellent resistances

#### ▪ Abrasion resistance:

a) Abrasion tester APG (Dr. Wazau; SN 27650):  
> 4 m (157.5 inch) load: 100 N/cm<sup>2</sup>



b) TABER<sup>®</sup> ABRASER (25 cycles; load: 500 g;  
wheel: CALIBRASE<sup>®</sup> CS-10F)

gloss unit (60°):	before testing	after
Norilux <sup>®</sup> DC-10	150 GU	110 GU
Norilux <sup>®</sup> DC-10/001	20 GU	20 GU

(substrate: PC film Makrofol<sup>®</sup> DE 1-1)





- **Hardness:**

- a) Pencil hardness: 2 H on Makrofol® DE 1-1

- b) Erichsen hardness: 2.5 N on Makrofol® DE 1-1

Results mainly depend on the hardness of the substrate (PC film)!

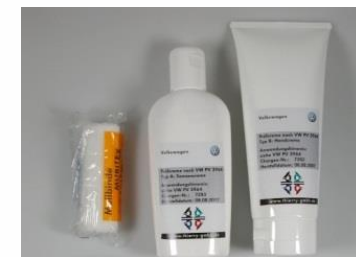
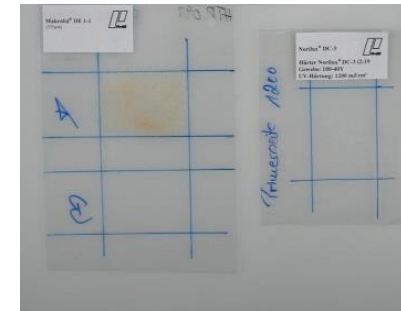


- **Chemical resistance:**

Tests according to automotive specifications

- 1) PV 3964 VW AG

- 2) GMW14445



## ▪Chemical resistance:

Some tests according to automotive specifications are fulfilled:

- 3) **VW50014 Ausgabe 2014-04 (PTL 8140)**
- 4) **VW 96183 Ausgabe 2017-05 (PTL 5536)**
- 5) **VW50190**
- 6) **Daimler DBL 9202 (Cockpit care product, Plastic cleaner)**
- 7) **PN 780 (2017-01)**

## Resistance Test Results Norilux® DC-10 high gloss

Test, Testing Medium	Evaluation:	Norilux® DC-10 high gloss (a)	according to DIN	Test-parameter	Temp.
<b>Fastness to saliva</b>		++	53160-1	2 h	37 °C / 99 °F
<b>Fastness to perspiration</b>		++	53160-2	2 h	37 °C / 99 °F
<b>Water resistance:</b>	Visible change of printed film	++	ISO 2836	24 h	20 °C / 68 °F
<b>Solvent resistance:</b>			ISO 2836	5 min	20 °C / 68 °F
- Ethanol	Visible change of printed film	++			
- Test mixture (b)	Visible change of printed film	++			
<b>Fuel resistance:</b>			ISO 2836	5 min	20 °C / 68 °F
- Premium	Visible change of printed film	++			
- Regular gas	Visible change of printed film	++			
- Diesel	Visible change of printed film	++			
<b>Alkali resistance:</b> - 2.5 % NaOH-solution (water)	Visible change of printed film	++	ISO 2836	10 min	20 °C / 68 °F
<b>Detergent resistance:</b> - 1% Persil®-solution (water)	Visible change of printed film	++	ISO 2836	3 h	20 °C / 68 °F
<b>Resistance to vegetable fat:</b> - Sunflower oil	Visible change of printed film	++	ISO 2836	24 h	20 °C / 68 °F
<b>Resistance to skin cream:</b> - Nivea®	Visible change of printed film	++		24 h	20 °C / 68 °F
<b>Heat resistance</b>		+ (c)		30 min	120 °C / 248 °F
<b>Level of gloss (d)</b>		156			
<b>Test TABER® ABRASER (e)</b> Level of gloss according to abrasion		128		25 cycles	
<b>Test WAZAU (f)</b>		> 4 m		2,5 N	
<b>Acid resistance:</b> - sulfuric acid $\delta = 1.24$ g/ml	Visible change of printed film	++		5 min	20 °C / 68 °F
<b>Cross-hatch adhesion test (g)</b>		Gt 0	ISO 2409		

## Resistance Test Results Norilux<sup>®</sup> DC-10 high gloss

Test, Testing Medium	Evaluation:	Norilux <sup>®</sup> DC-10 high gloss (a)	according to Standard	Test-parameter	Temp.
<b>Resistance to skin cream:</b>	- Type A Sunblock (h) Visible change of printed film	++	PV 3964 VW AG	24 h	80 °C / 176 °F
	- Type B Hand cream (h) Visible change of printed film	++			
<b>Resistance to skin cream:</b>	- Test Solution Type Sun Protection (i)	++ (j)	GMW14445	1 h	80 °C / 176 °F
<b>Conditioning cabinet (l)</b>	Visible change of printed film Cross-hatch adhesion test (g)	++ Gt 0	ISO 2409	Proell2 (k)	

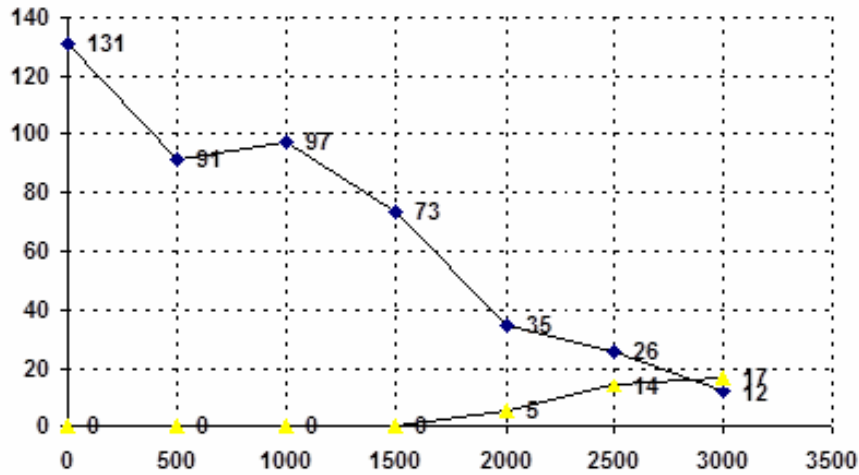
## Smart surface protection with Norilux DC

**Suntest® XLS+:** Manufacturer: ATLAS MATERIAL TESTING SOLUTIONS,  
Xenon arc lamp NXe 1500B, Duration: 168 hours (7 days)

product	b* (before)	b* (after)	$\Delta b^*$	$\Delta E$
Norilux® DC-10 high gloss	3,96	4,9	0,94	0,99
Norilux® DC-10/003 high gloss, UV stabilized	4,17	4,43	0,26	0,29
Norilux® DC-10/001 matt	4,08	5,16	1,07	1,13
Norilux® DC 10/004 matt, UV stabilized	4,34	4,53	0,18	0,26

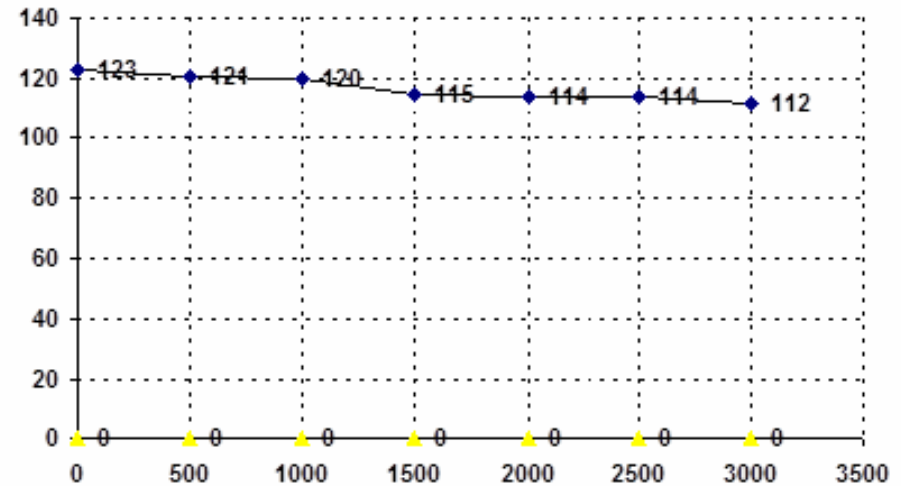
## QUV Accelerated weathering test

Norilux® DC



hours	1500	3000
Delta E	12.69	14.33

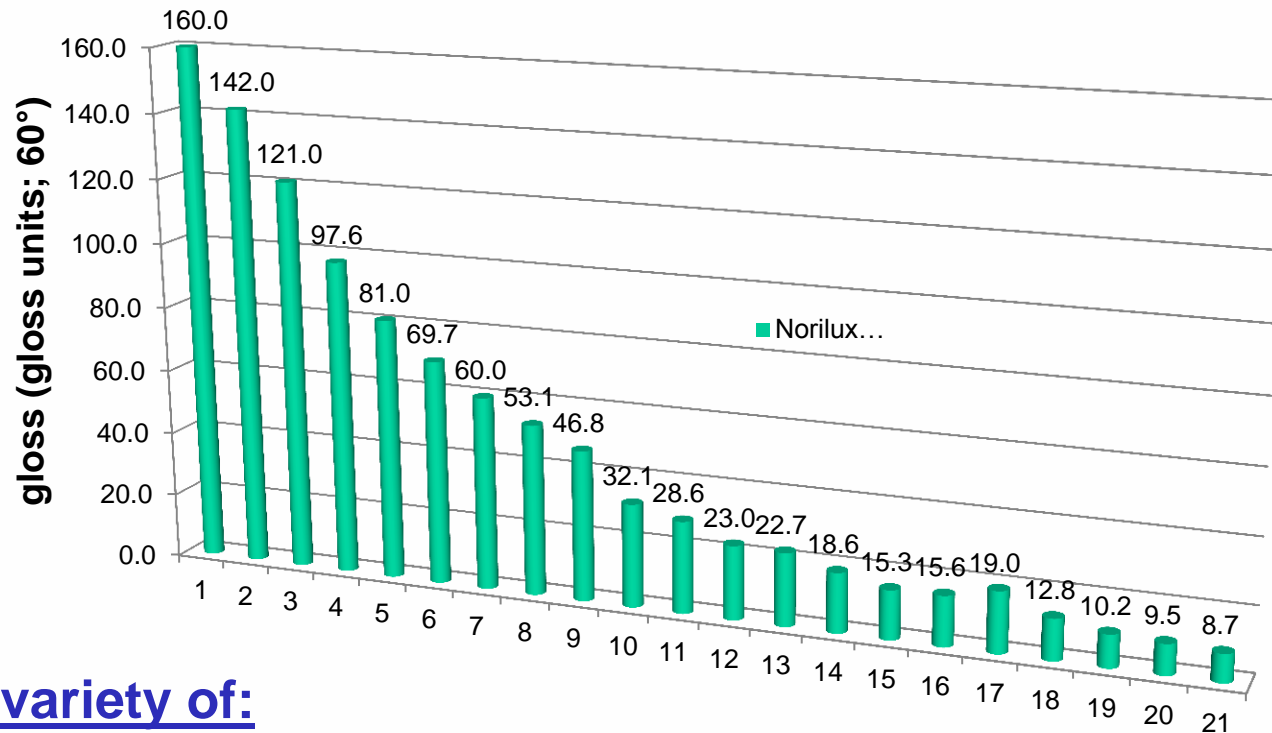
Norilux® DC UV stabilized version



hours	1500	3000
Delta E	1.14	2.19

Substrate: PMMA

## Smart surface protection with Norilux DC



Large variety of:

Matt degrees, color shades, effect colors, special versions for effect prints

## Smart surface protection with Norilux DC

**Norilux® DC-10 high glossy**

**Norilux® DC-10/001 matt**

**Norilux® DC 10/003 glossy, UV stabilized**

**Norilux® DC- 10/004 matt, UV stabilized**

**Other versions are available on request.**

### Summary

Most important properties of Norilux® DC

- **highly formable**
- **excellent chemical resistance**
- **excellent abrasion resistance**

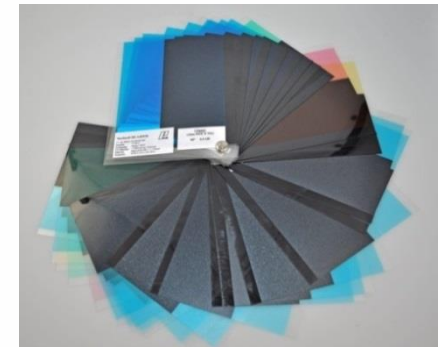




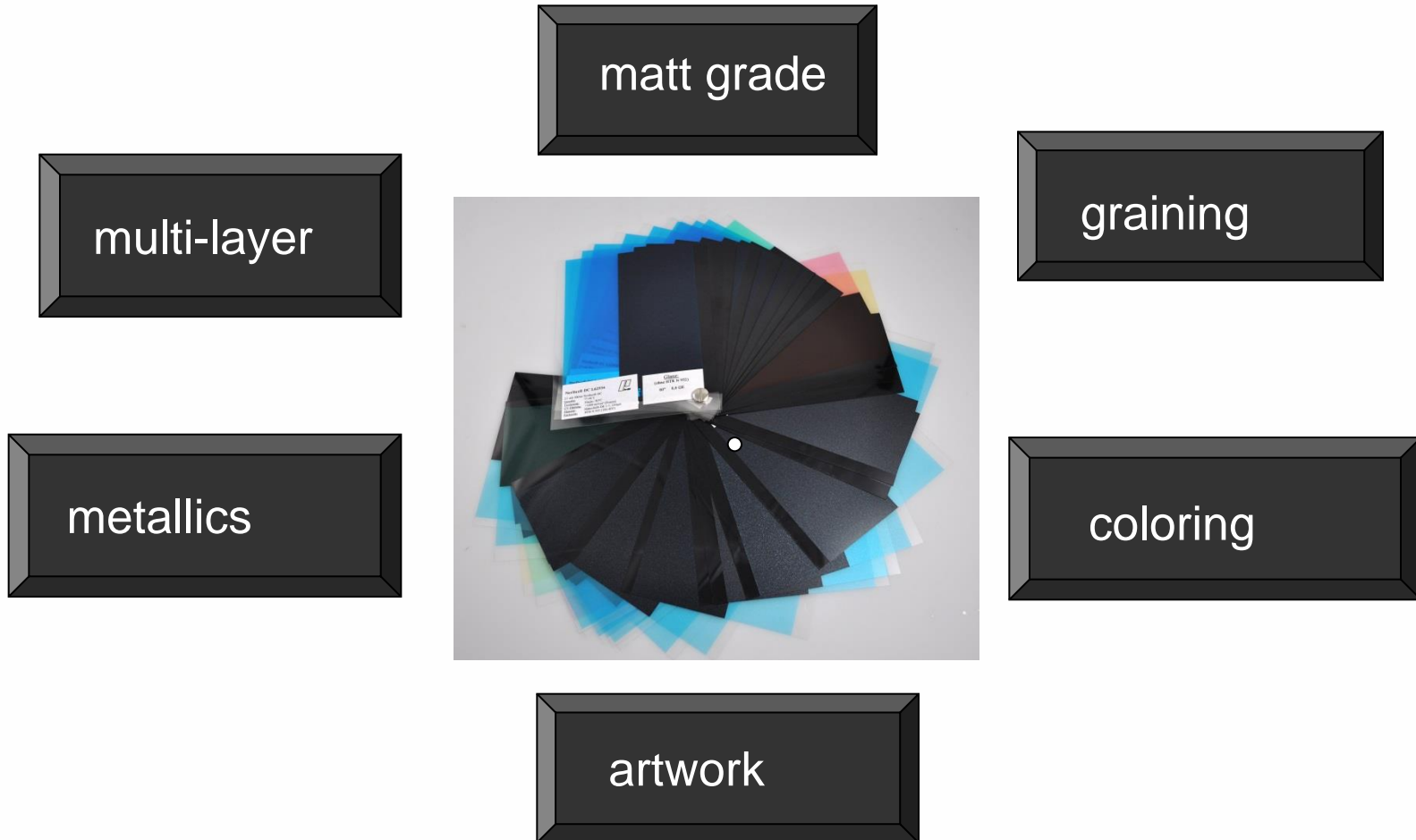
## Smart surface protection with Norilux DC

### “FIM + Norilux DC” **advantages:**

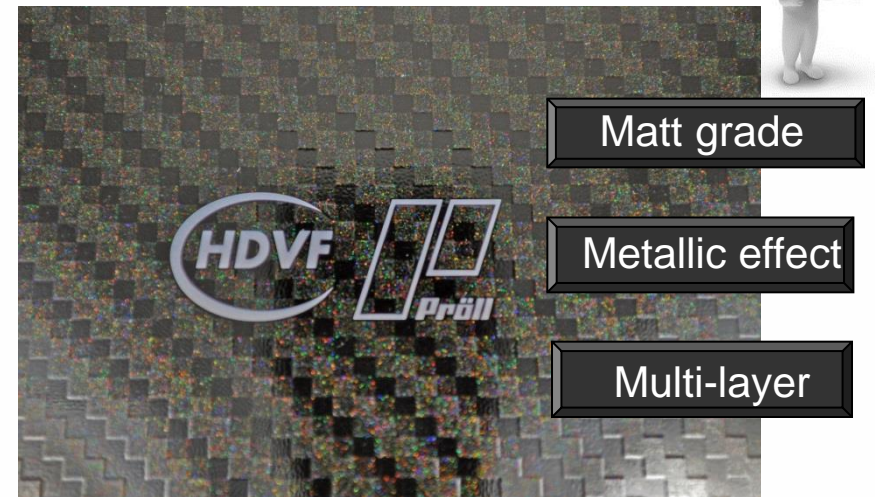
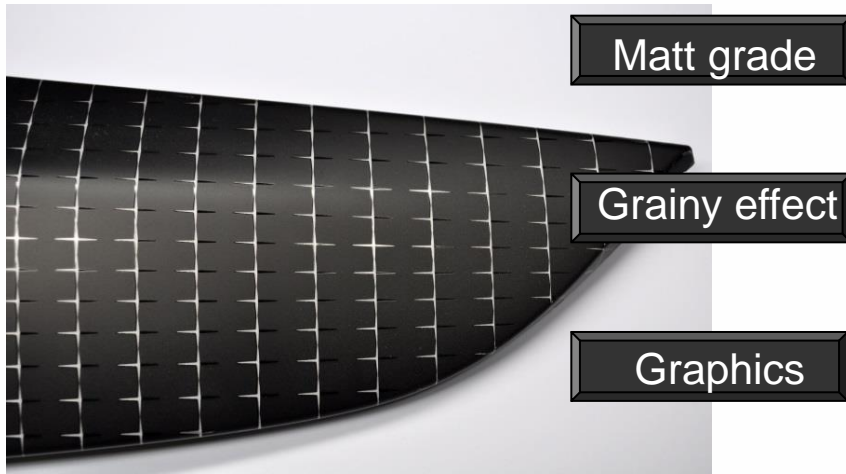
- ✓ Freedom of design (3D and effect graphics)
- ✓ Backlit option day/night design
- ✓ Hiding flow lines
- ✓ Protected second surface decoration
- ✓ Chemical and abrasion resistant surface
- ✓ Matt and high gloss surfaces in one part
- ✓ hard surface, 2H, (DE 1-1)
- ✓ excellent sun lotion resistance



# Smart surface protection with Norilux DC



## Effect Design samples



## High gloss project samples



**By Norilux DC-10**

## Automotive trims and bezels



## Matt effect project samples



Lincoln MKZ



**Makrofol® HF278 G-4 265µm**  
large area w/ matte  
Norilux DC coating  
by Proell

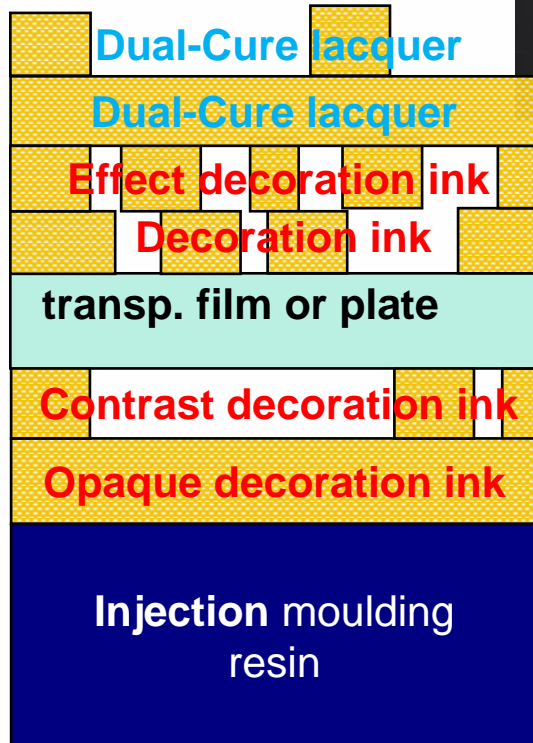
- capacitive touch slider
- black panel design

**preh**

**New Albea** KUNSTSTOFF  
TECHNIK  
*Innovation der Zukunft*

[http://www.automationallev.com/a2\\_nws\\_newsdetail?id=a0M6000000D4AQdEAN](http://www.automationallev.com/a2_nws_newsdetail?id=a0M6000000D4AQdEAN)





Stronger capability, not fully utilized yet !!





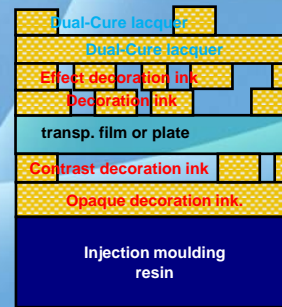
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Many thanks and  
remains open  
for challenges...

# COLORS ●●●● FOR SUCCESS



Hardware = **ink**



**New Concept**

software = **Design**