



Science For A Better Life

New Processes Improving Efficiency & Design Flexibility

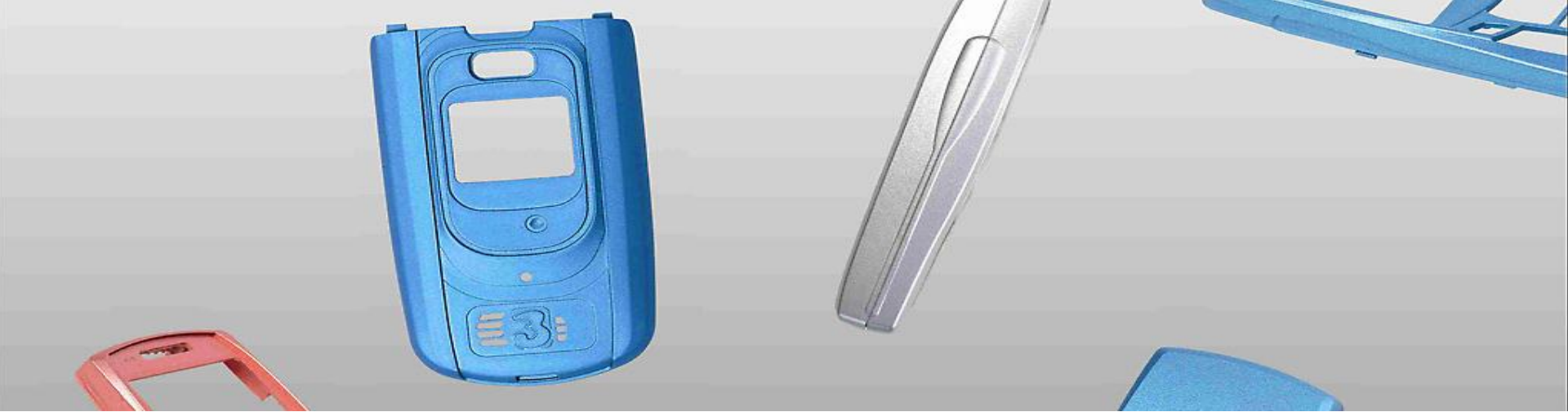
Eco-friendly, economic, efficient & flexible solutions for 3C

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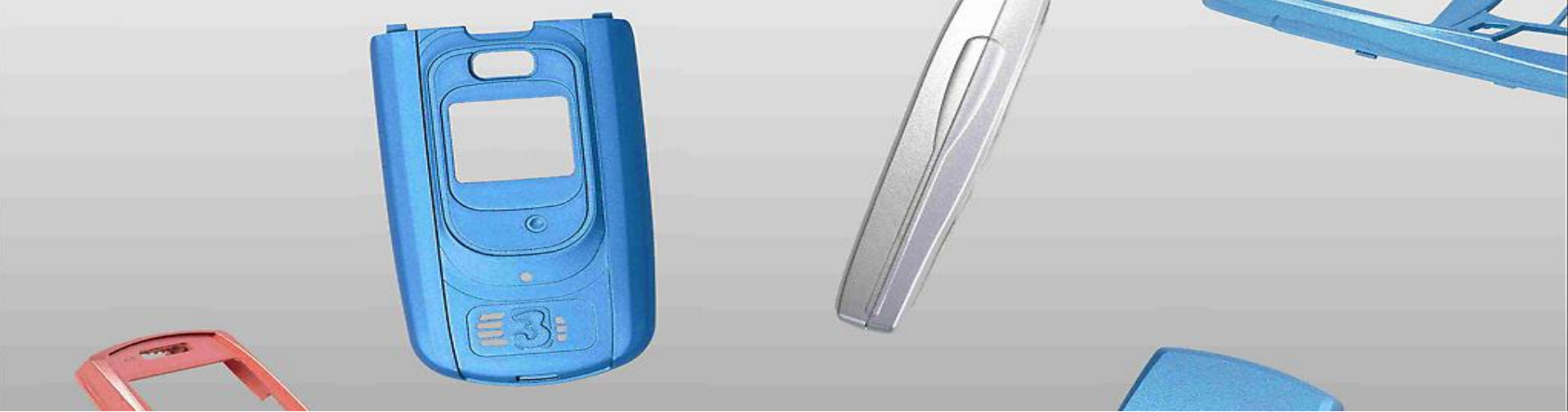
CAS BD APAC

August 16/17, 2012



Agenda

- 3C Market
- Green, Efficient, Flexible Process: FIM
- New Coating Concept: DirectCoating
- Application Examples
- Conclusions



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3C Applications 什么是3C



Computer

Communication

Consumer electronic

3C Market Trends & Offers from BMS

3C市场发展趋势以及BMS所能提供的方案

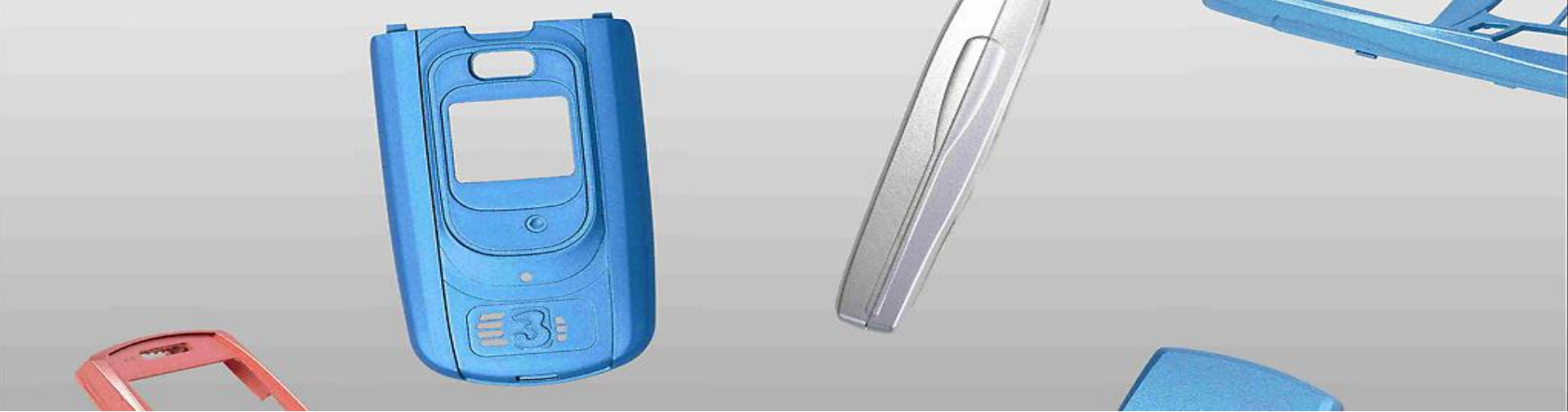


3C Market trend 市场趋势

- Development of GREEN solutions decreasing VOC in coating formulations
绿色环保，低VOC涂料配方的研发
- Increase productivity and design flexibility 提高生产效率和设计灵活性
 - Increased use of UV coatings 紫外光固化涂料的大量使用
 - Replacement of traditional spray application by film applications (e.g. in-mould decoration) 薄膜工艺替代部分传统喷漆工艺

Offers from BMS to meet the demand of the latest trends BMS的解决方案

- Waterborne PU coatings 水性聚氨酯涂料原材料
- Waterborne UV coatings 水性紫外光固化原材料
- Raw material solution for film applications 薄膜涂料用原材料
- New coatings concept: Direct Coatings 涂装新概念：直接涂层



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New & Efficient Production Processes of Coated Plastic Parts 新生产工艺



Technology today: First thermoplast moulding, then spray coating

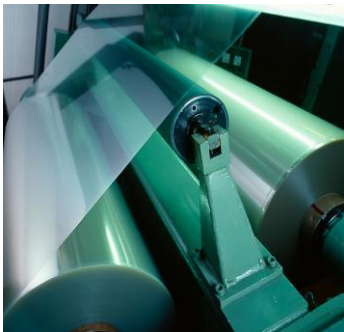
现有的技术：先成型再喷漆



- Expensive paint shops 昂贵的喷漆车间
- Overspray 喷漆的浪费
- Long oven drying time (30 min.) 干燥时间长
- Complex process sensitive to paint defects 缺陷多

Reversed process: First PC-film coating, then component forming

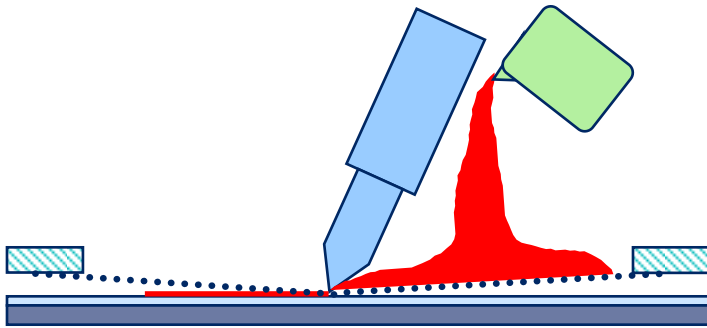
新工艺：先制备预涂PC薄膜再成型



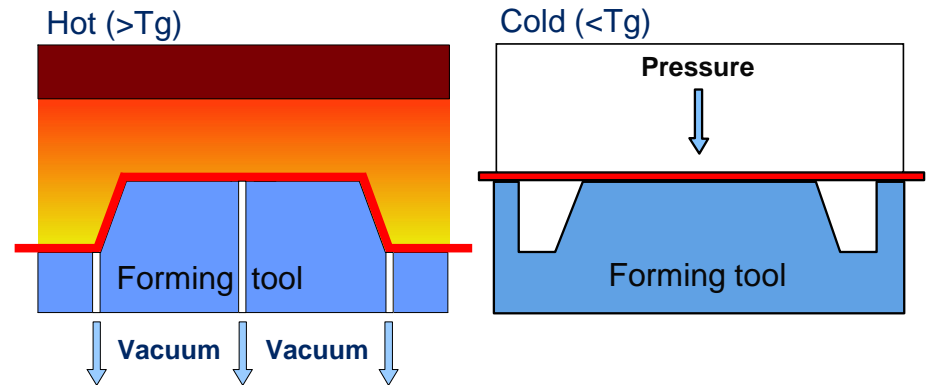
- No paint shop required at the IT OEM 无需喷漆车间
- No overspray for 2D film coating 无喷涂浪费
- Lean process with short drying time & less paint defects 简洁工艺并且较少的漆膜缺陷
- More design flexibility; films can be decorated using printing 设计更加灵活，薄膜可采用印刷工艺

FIM: Process 工艺

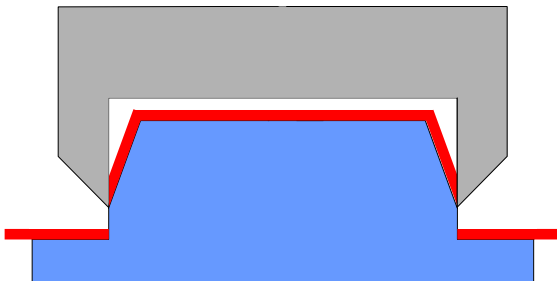
1. Printing



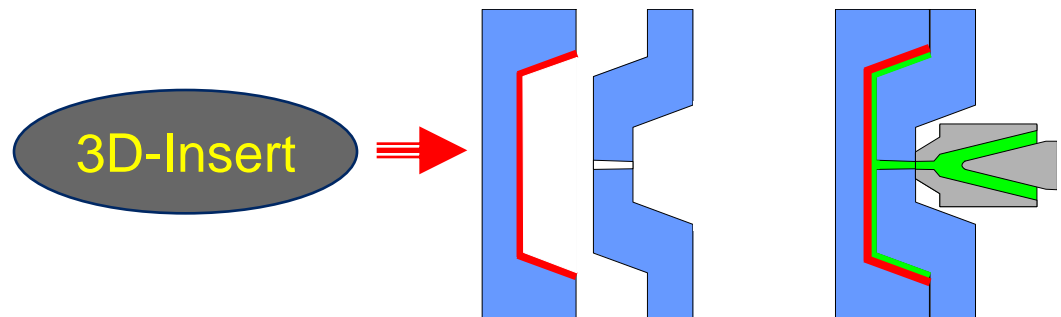
2. Forming



3. Trimming (2-D and 3-D)



4. Back molding





FIM: benefits 优点

- **scratch and wear resistant decoration**
耐刮擦、抗磨损型表面装饰工艺
- **accurate position of printed symbols on 3- D geometry**
将印刷图案精确定位于3D曲面上
- **back-lighting**
可集成带有背光的图案
- **high resolution of decoration / accurate symbols**
印刷图案的解析度高, 图标表现精确
- **easy change of design/ design freedom**
设计自由度高, 且易于更换设计图案

Challenge & Solutions to Obtain Hard Coats in FIM Process 挑战与解决方案



Thermoforming of fully cured films 彻底固化后成型

- Fully cured soft coatings are thermoformable but do not meet e.g. hardness, chemical resistance, scratch resistance requirements
软涂层容易成型，但性能达不到要求
- Fully cured hard coatings will crack when thermoforming process is conducted
硬涂层容易达到性能要求，但成型过程容易开裂

How to obtain a hard coat where a thermoforming step is part of the process?

❖ **A two step curing process is required** 需要两步固化

Bayer MaterialScience offers : Waterborne UV system for FIM process

拜耳公司的解决方案：水性UV涂料原材料用于FIM工艺



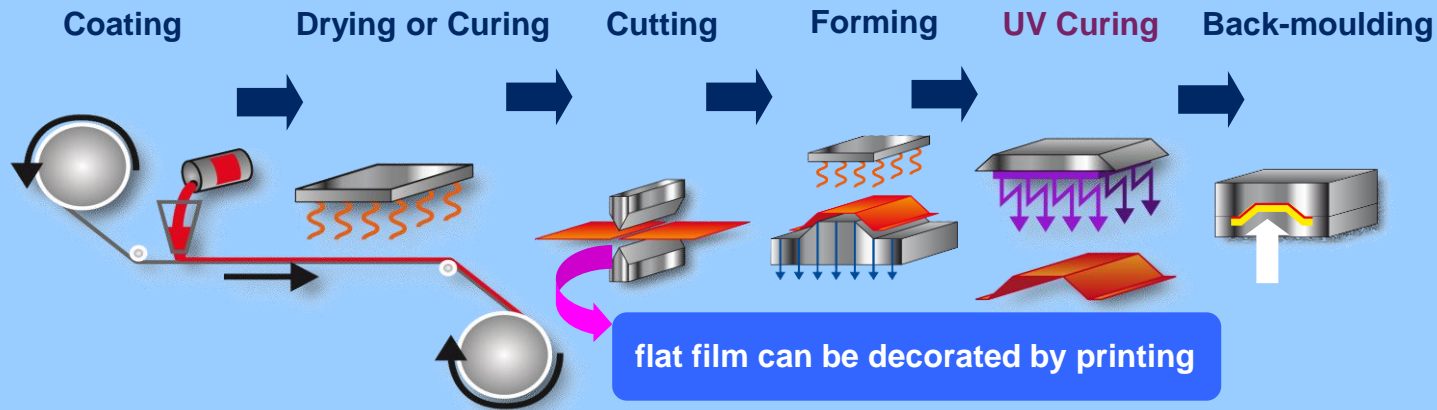
Advantages of WB UV Coating 水性UV优势

- Fast drying / high productivity 快干，高效
- Low VOC/ environmentally-friendly, the greenest technology 环保
- Energy saving 节能
- Can be used for heat-sensitive substrates 适合热敏感的塑料基材
- Excellent performance: high chemical and mechanical resistance 性能优异
- One component: easy to handle & apply 单组份，方便使用
- **Two step drying: physical drying after water evaporation and UV curing**
两步固化：UV前水挥发后即表干，最后UV固化彻底干燥

Film Insert Moulding 模内注塑工艺

Use of Pre-coated Thermoformable Films

Film insert molding process (or also called “IML” process)



Step 1 第一步：表干

Foil coating with clear coat

涂装清漆

- post formable, but blocking resistant
表干后具备抗粘连性

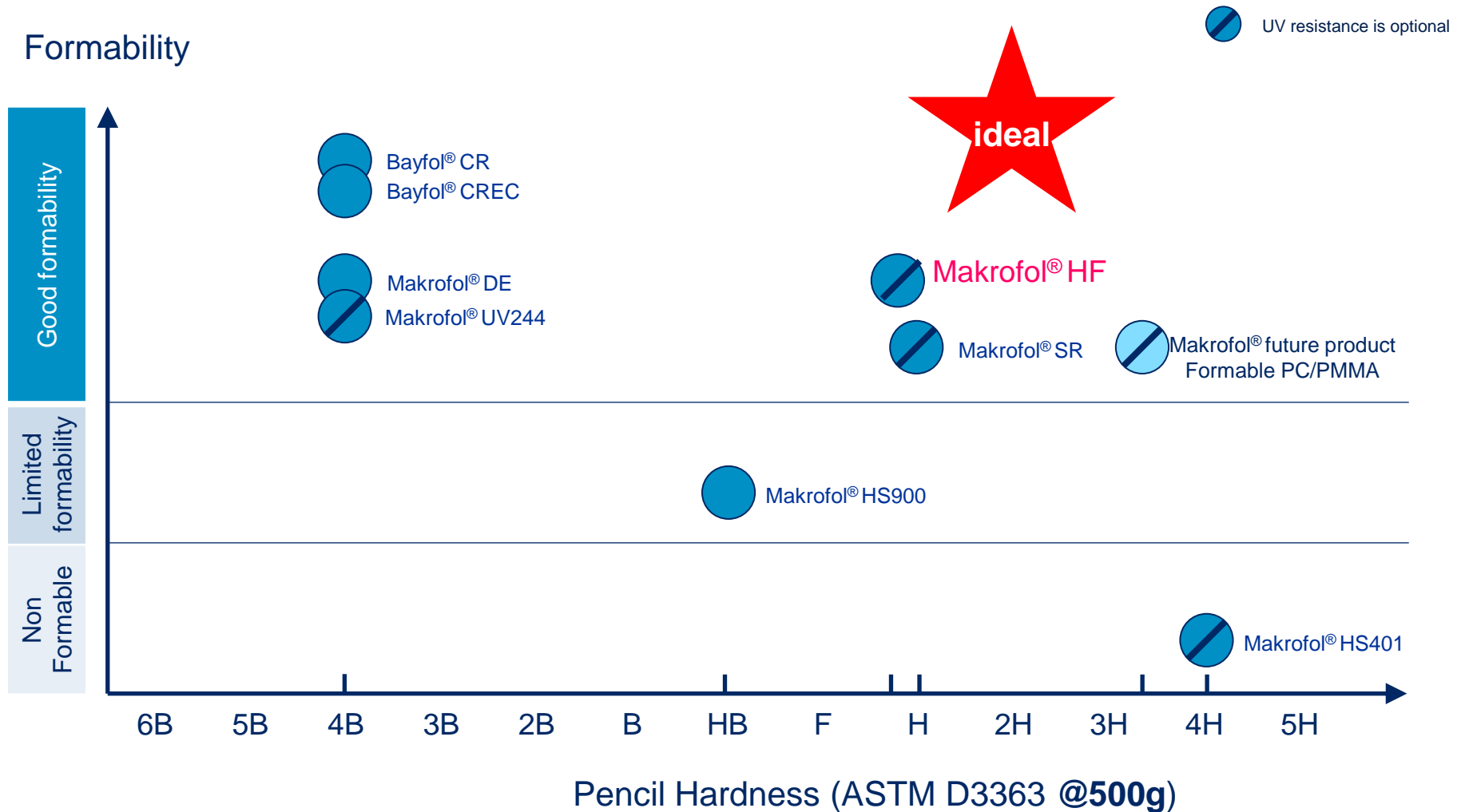
Step 2 第二步：UV固化

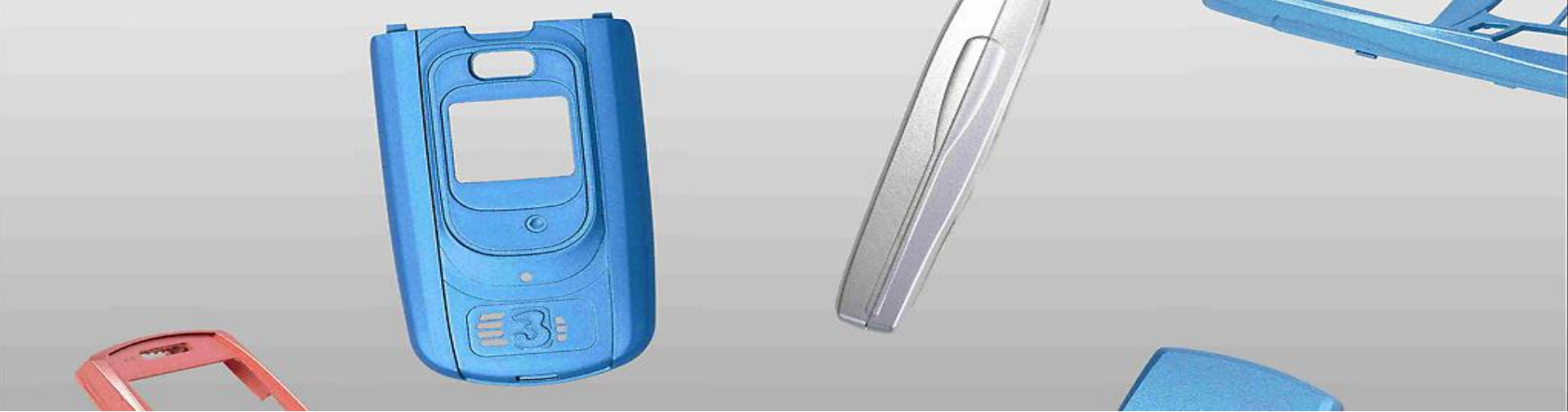
Thermoforming or high-pressure-forming of the coated film
热成型或高压成型

- UV curing of the final shape
最后紫外光固化

PC Films: Surface Hardness & Formability

PC薄膜的表面硬度和可成型性





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What is DirectCoating? 什么是直接涂层?

DirectCoating

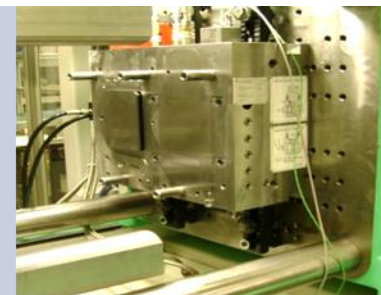
- is not only a coatings technology, but also a process technology
- is based on solvent free aliphatic polyisocyanates and solvent free hydroxyl functional polyols
- integrates plastic injection and coatings process
- is injected through reaction injection machine



Injection Moulding Machine



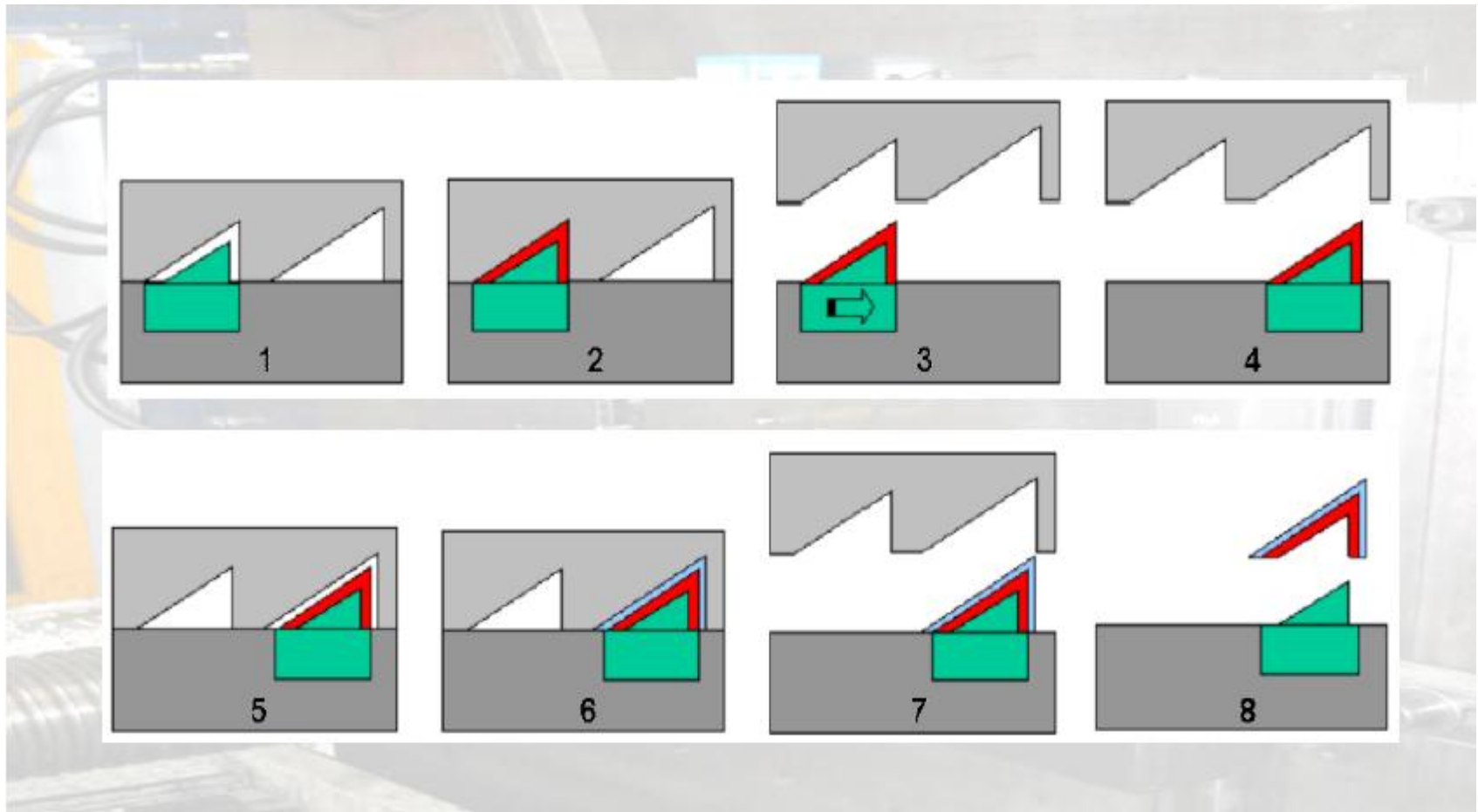
Reactive Injection Machine



Two Cavity Mould

DirectCoating 直接涂层

Dual-Cavity Approach



DirectCoating Process Video

直接涂层工艺



Direct Skinning/Direct Coating

Combination of Injection Molding and RIM

DirectCoating 直接涂层与传统涂装对比 Comparison with Standard Coating



Standard Coating



Injection Molding

Transport
(intermediate
storage)



Cleaning
(degreasing)

Coating
(clean room)
+
Curing

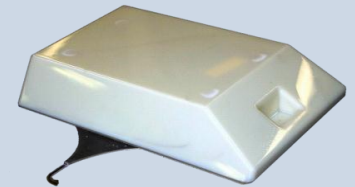


Finished part

DirectCoating

Two-step process

- Injection of the thermoplastic (Injection Molding)
- Injection of the coating directly in the mold (RIM)



Finished part

DirectCoating 直接涂层与传统涂装对比 Comparison with Standard Coating



Standard Coating



- **Expensive**
 - Separate steps
 - Clean room
- **Additional costs**
 - Long process chain
 - Contamination
 - Damage



– **Scrap rate increase!**

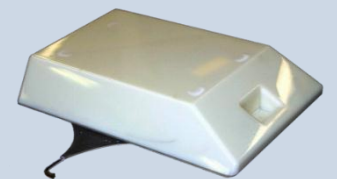
DirectCoating

- **Eco-friendly**
- **Eliminate spray line**
- **No baking oven**
- **Cost effective**
 - Process integration
 - Short process chain
 - No clean room



High-grade surface

- Possible layer thickness: 0.1 – 10 mm and more
- Surface feel (soft and hard)



DirectCoating 直接涂层

Suitable Material Systems 原料体系



Unique and tailor-made systems

DirectCoating :

- Aliphatic 2K-PU coating based on Desmophen®/Desmodur®
- High gloss, hard and scratch resistance topcoat
- Soft feel and various patterns

Substrate: Bayblend® PC-ABS,
Makroblend® PC-PBT/PET,
Makrolon®, Apec® PC

Customer Project Feasibility Study of Soft-feel Surface

客户项目可行性研究--软触表面效果



Application: Switch-cover (prototype)

Carrier: Bayblend® T85

Coating: Desmophen®/Desmodur®

- ❑ Aliphatic-based paint
- ❑ Pleasant surface touch
- ❑ Layer thickness distribution:
From 0.8 down to 0.3 mm
- ❑ Different colors possible
- ❑ Good replication of mold surface structure

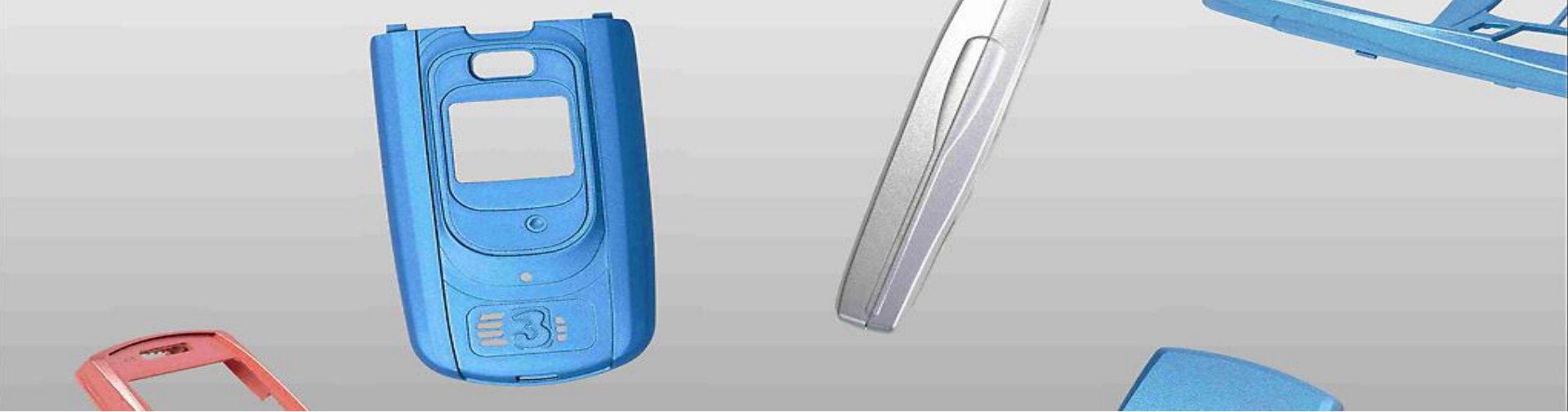


DirectCoating 直接涂层

Summary 总结



- ❑ Direct coatings is a green and efficiency technology
- ❑ Direct coatings is a production complexity “Reducer” with high potential for cost-effective and valuable surface finish
- ❑ Hard coat, soft-touch feel, glossy surface and texture appearance are achievable. Paint film thickness various from 0.1 to 1mm are possible.
- ❑ Wide range of possible applications on IT and automotive industries
- ❑ Support customer to conduct feasibility studies, process development and also mass production projects



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Applications: FIM Head Lamps



Product	Renault Clio Headlamps
Material	Makrofol® DE 1-4, 475 µm
Attributes	<ul style="list-style-type: none"> - giving a smooth transition - colored according to Renault specification - hard coated for outdoor application - significant improvement in productivity (plus a definite cost advantage)

Applications: FIM Housings



PHILIPS
sense and simplicity*

Product	Philips HQ7140 Electric Razor
Material	Bayfol® CR 1-4 175µm
Attributes	<ul style="list-style-type: none"> - Good chemical resistance - Excellent formability (even Cold Forming) - High transparency for backlit symbols - High printability

Applications: FIM Housings



 **CaptionCall**
Life is Calling



Product	Ocular Caption Call Desk Phone
Material	Makrofol® SR 253, 250µm
Attributes	<ul style="list-style-type: none"> - Good chemical resistance - Good formability (up to 13mm) - High Gloss PMMA surface - Surface Hardness up to 1H

Applications: FIM Housings



Product UEI ONE for All® Xsight Touch

Material Makrofol® SR 253, 250µm

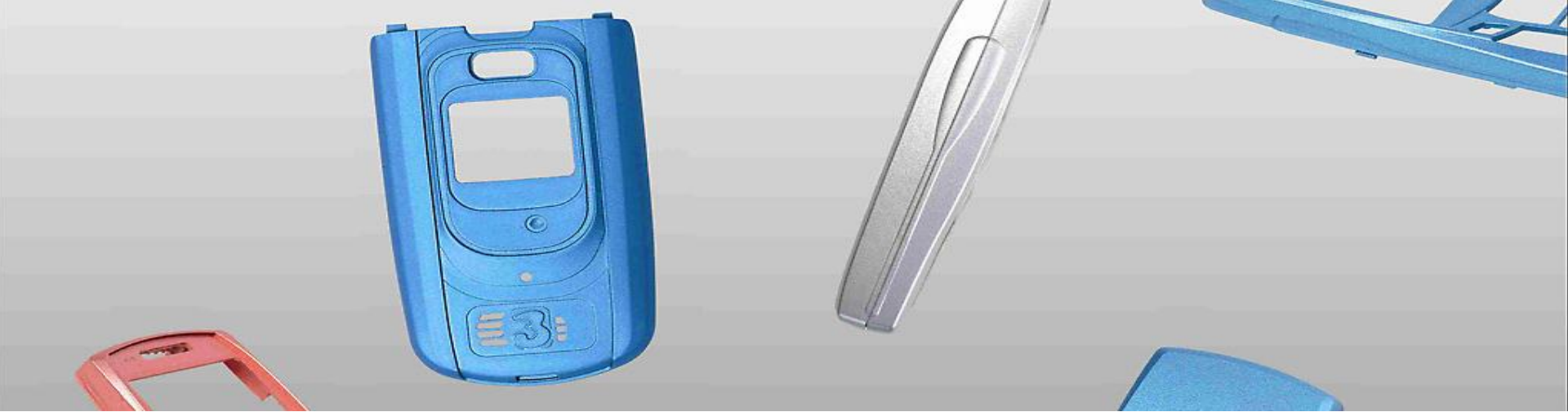
Attributes

- Good chemical resistance
- Good formability (up to 13mm)
- High Gloss PMMA surface
- Surface Hardness up to 1H

Functional Films TechCenter



→ www.makrofol.com & www.pc-films.com
(homepage) (techcenter)



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Conclusions 结论

- The development of eco-friendly coating systems and the need to improve productivity and design flexibility has been observed as the latest trends in the 3C industry.
3C行业的最新趋势：环保，高效和设计灵活
- Bayer MaterialScience provides solutions to meet the latest trends in 3C
拜耳材料科技可提供的相应解决方案
 - Waterborne PU and UV coating systems are enabling the formulation of environmentally coatings with excellent performance **环保：水性PU和水性UV**
 - Bayer MaterialScience offers waterborne UV products especially designed for UV curable thermoformable pre-coated films to be applied in the film insert moulding process or other film technologies **薄膜工艺：水性UV**
 - Bayer MaterialSciences introduces a new coating process, *i.e.* direct coatings, which combines high performance, environmental friendliness and an economic process **新涂装概念：直接涂层**



Science For A Better Life

Thank you!

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