



performance materials strategy update

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July 3, 2018



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Executive Summary

MERCK KGaA, Darmstadt, Germany Performance Materials...

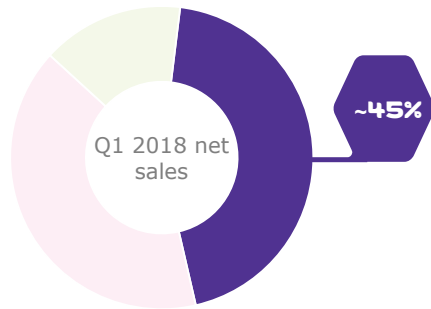


- ...is and will continue to be a strong contributor for the Group
- ...is operating in attractive markets and has a relevant position in the electronic materials space
- ...has a strong set of capabilities to address the specific industry needs
- ...is set up with a new, experienced and diverse management team
- ...introduced an improved organizational structure and an integrated R&D approach
- ...defined a clear portfolio approach to ensure effective resource allocation
- ...will return to sales and earnings growth after 2019
- ...will deliver ~30% margin, which is significantly above specialty chemicals peer average

A platform of three high-tech & science businesses to compete in attractive markets



Healthcare

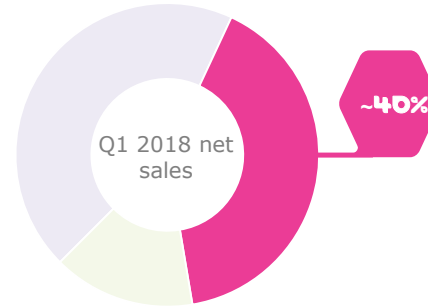


Leading in specialty pharma markets

- Biologics and small molecules
- Research focus: Oncology, Immunology & Immuno-Oncology



Life science

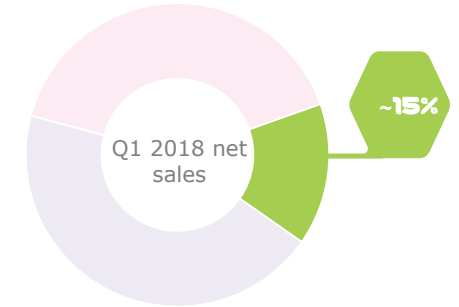


Leading life science company

- Tools and services for biotech research & production
- Tools and laboratory supply for the academic research and industrial testing



Performance Materials



Leading Company in high-tech solutions

- High-tech solutions and materials for electronics
- Broad portfolio of decorative and functional solutions

Well-defined business sector priorities to drive long-term success

Group

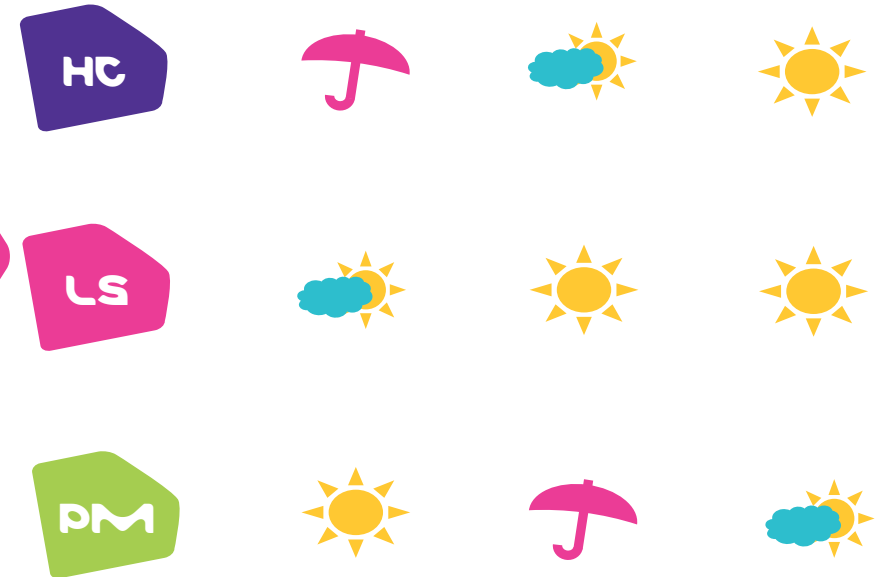
- Advancing science & technology
- Family as majority owner
- Thinking in generations

FOCUS & GUARDRAILS

- Diversification of risk
- Market leadership & innovation
- Long-term success
- Group financial ambition

portfolio

2011 - 2015 2016 - 2018 2019 - 2022



Performance Materials targets attractive markets – especially in the electronics space

electronics Market



Market size:
~€1,250 bn
CAGR 18-25:
~4%

Performance Materials sales by end market



Automotive Market



Market size:
~€2,000 bn

- Driven by world GDP growth
- Increasing demand in emerging markets

cosmetics Market



Market size:
~€400 bn

- Driven by world GDP growth
- Rising living standards and higher disposable income

- Driven by digital disruptions and megatrends such as digitalization
- Heterogeneous end-user applications
- Semiconductors as the engine of all electronic systems

Source: McClean 2018/IC Insights 2017, Gartner 2017, Prismark 2018, Statista 2016
Abbreviation: CAGR = Compound annual growth rate; GDP = Gross domestic product

The electronics segment is driven by megatrends and serves various end markets



- Computer
- Consumer
- Automotive
- Communication
- Government
- Industry / Other



Electronics market is highly heterogeneous and therefore sustainable and less cyclical

Performance Materials is a leader in the electronic materials market

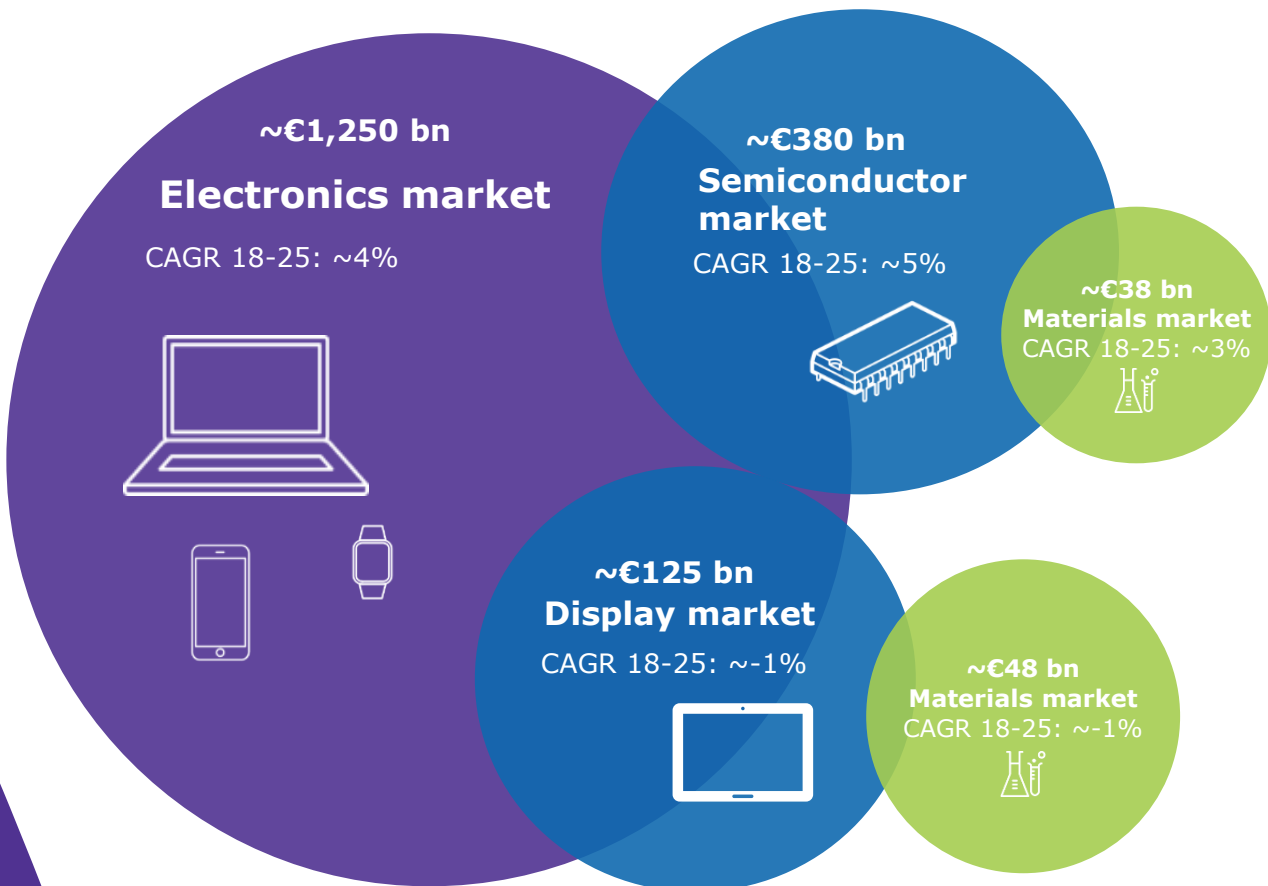
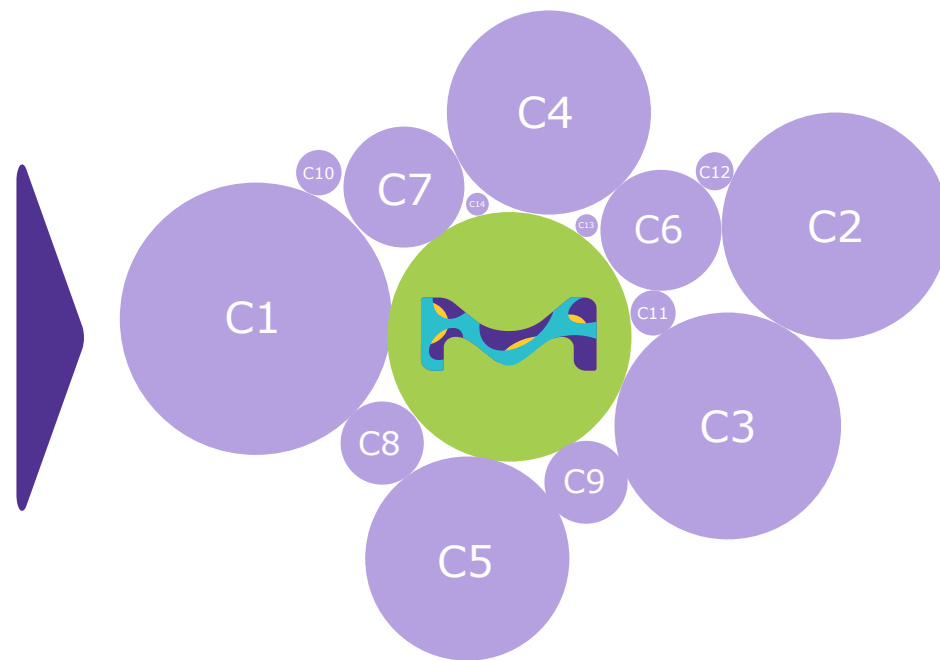


Illustration of the electronics market and thereof its selected sub markets

Electronic materials competitor landscape¹



¹Bubble size in competitive landscape illustrates share of semiconductor and display material sales of indicated competitors (C1 – C14)

Semiconductor Solutions products - key enabler for digital trends

semiconductor

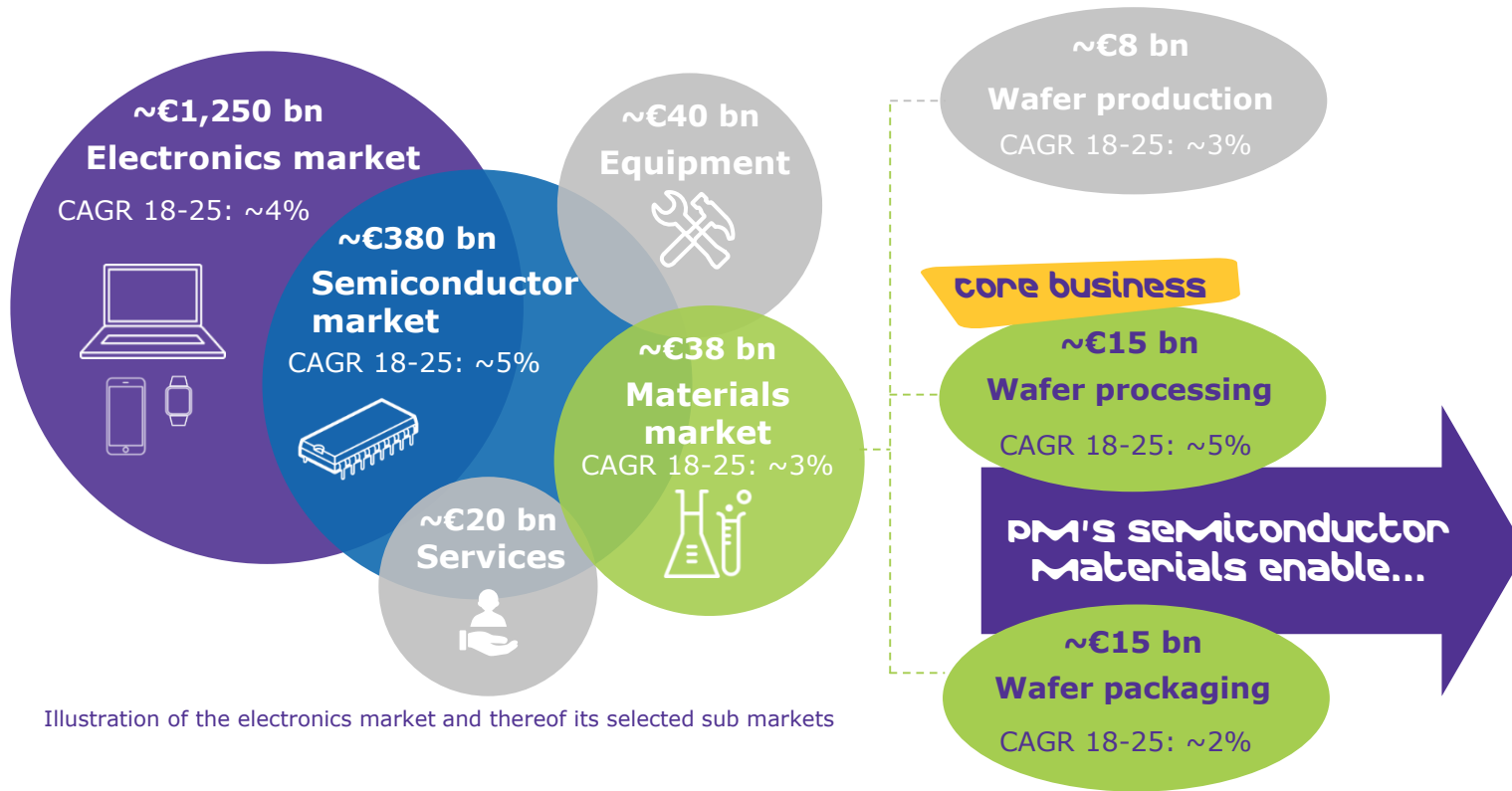


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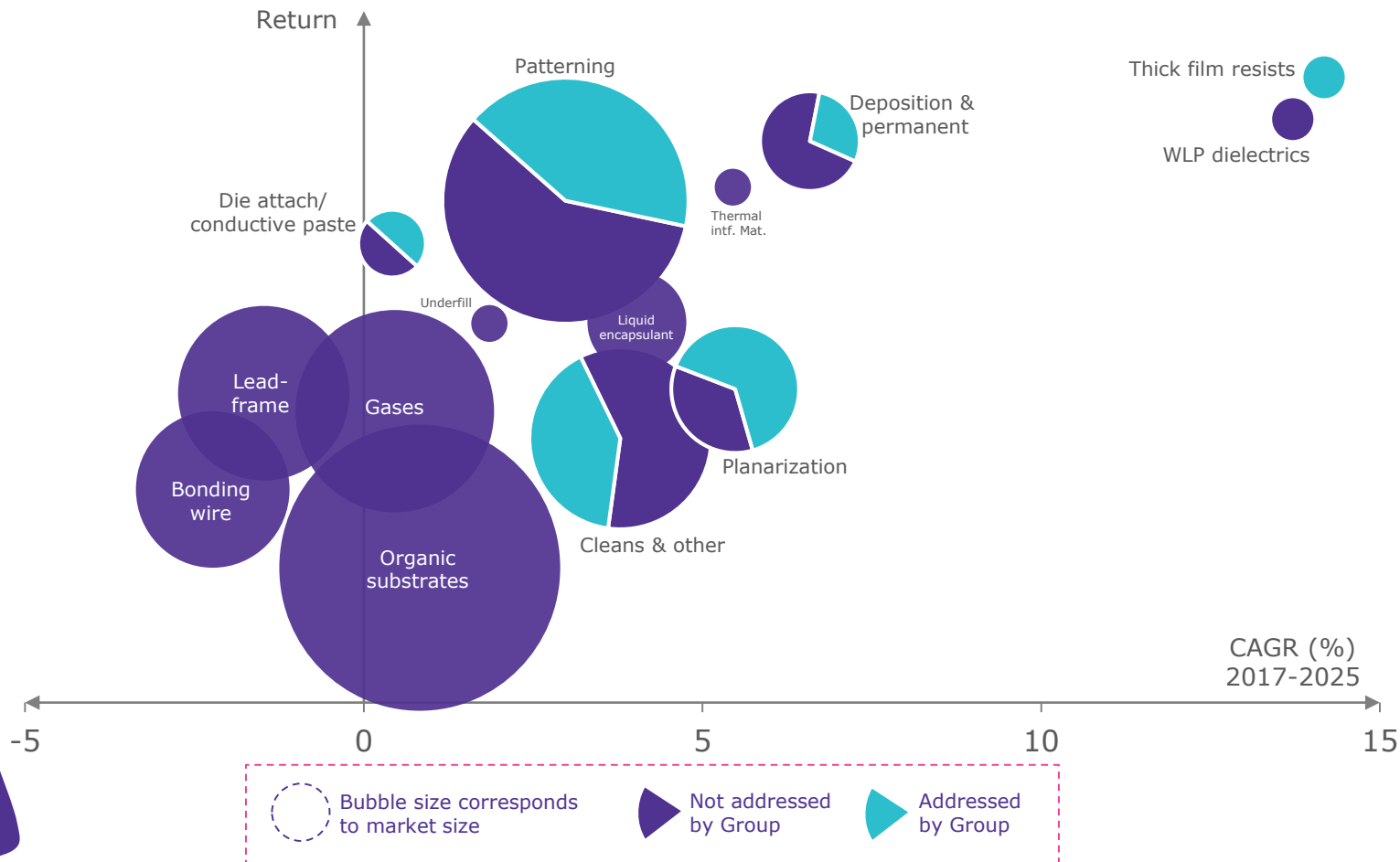
...customer needs

- Smaller structures beyond limitations of existing technologies
- Higher memory capacity, faster processing speed, less power consumption
- Improved yield and lower processing costs

Performance enhancing materials will benefit over-proportionately from attractive semiconductor growth rate of 5% CAGR

Semiconductor Solutions is well positioned in highly attractive market segments

Market landscape of wafer processing and packaging materials



Illustration;
Abbreviation: WLP Dielectrics = Wafer Level Packaging Dielectrics

Market positioning

- Positioned in attractive sub-segments
- Focus on enabling material solutions with small part in bill of materials
- Address innovative technologies through collaborative R&D
- Above-market growth
- Opportunities to increase footprint

Semiconductor Solutions is market-leader in crucial areas

Market requirements



customer intimacy



solutions



speed



quality

semiconductor solutions

- >30 years of experience
- Strategic partnerships
- Dedicated KAM
- Preferred partner for tool manufacturers

- Enabling solutions for smaller structures and 3D chip architecture
- Material pipeline filled with customer-relevant ideas
- Close cooperation and technical support

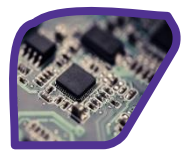
- First mover strategy for leading edge accounts
- Strong focus on customer-centric product life cycle management

- Proven track record of reliability
- Local support centers
- Deep understanding of critical production processes

Leading market positions



Deposition
#1 market leader



Spin-on dielectrics
#1 market leader



CMP Slurries
Top 3¹

Abbreviation: KAM = Key Account Management, CMP = Chemical Mechanical Planarization;
¹Corresponds to Merck KGaA, Darmstadt, Germany joint business with partners

Display solutions offers a healthy portfolio in maturing and growth markets

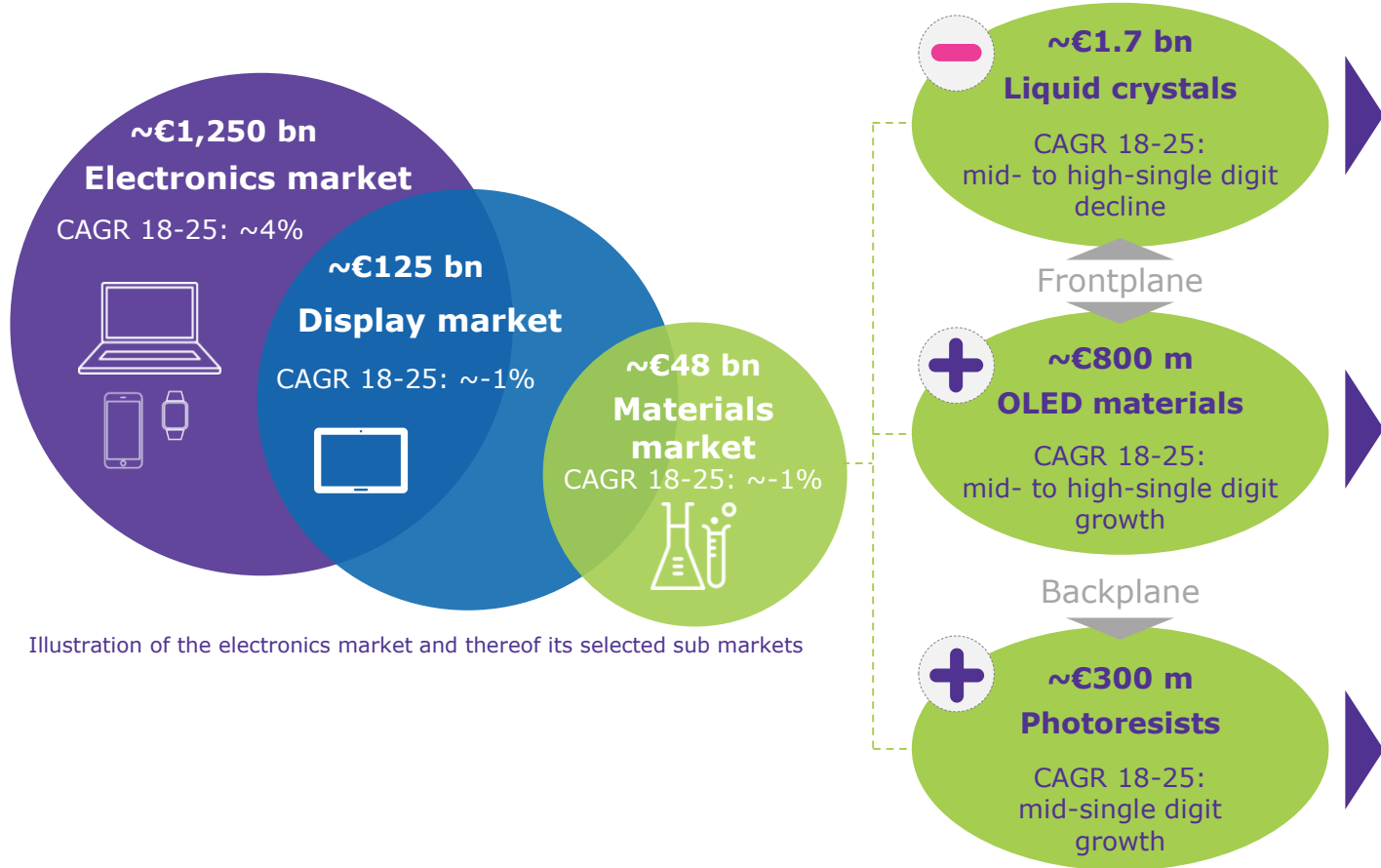
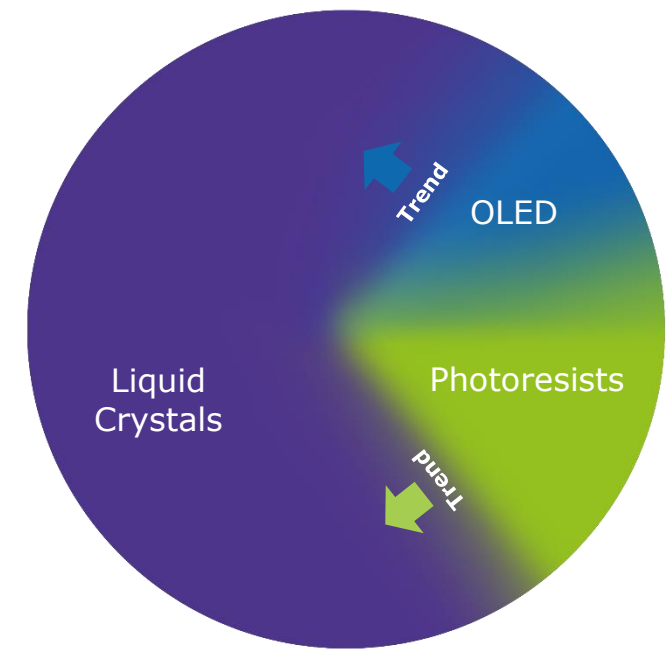


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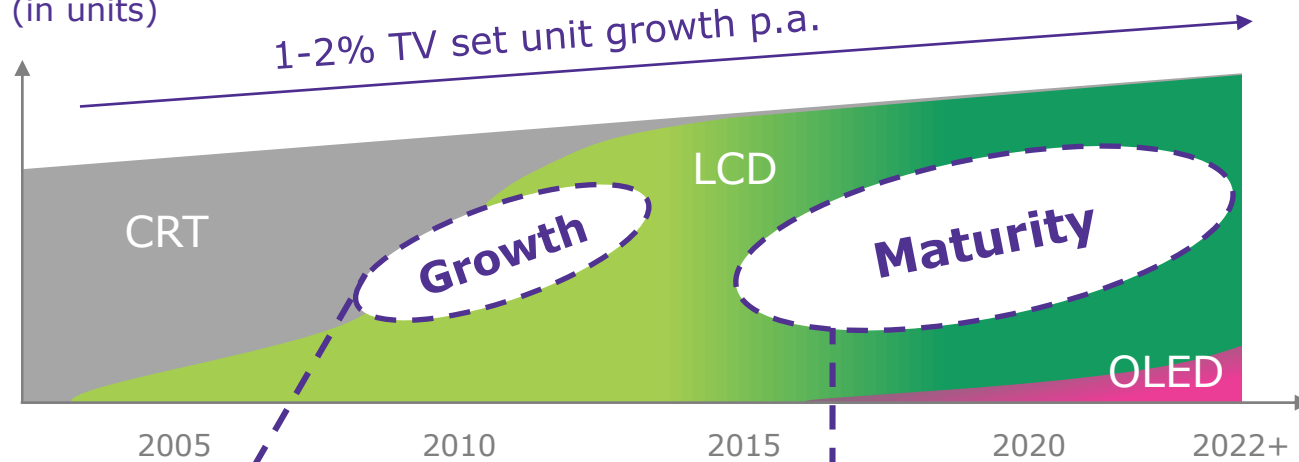
Display Solutions sales split and trend



Slower volume growth amid ongoing price decrease drives LC market decline of mid- to high-single digit CAGR

Maturing LC business continues to be highly attractive

TV set shipment development
(in units)



strategy – Managing Maturity Liquid Crystals

- Strengthening footprint in China given strong capacity shift
 - LC application lab in China
 - Dedicated resources
- Focus on relevant innovation and specific customer needs
 - Cost effectiveness (SA-VA)
 - Performance enhancement (UBplus)
 - New capacity ramp-up optimization (Service)
- Shift from top-line to bottom-line management

Impact on us:

- Vol. growth > price decline
- Innovation driven
- Limited competition
- Diverse customers

Impact on us:

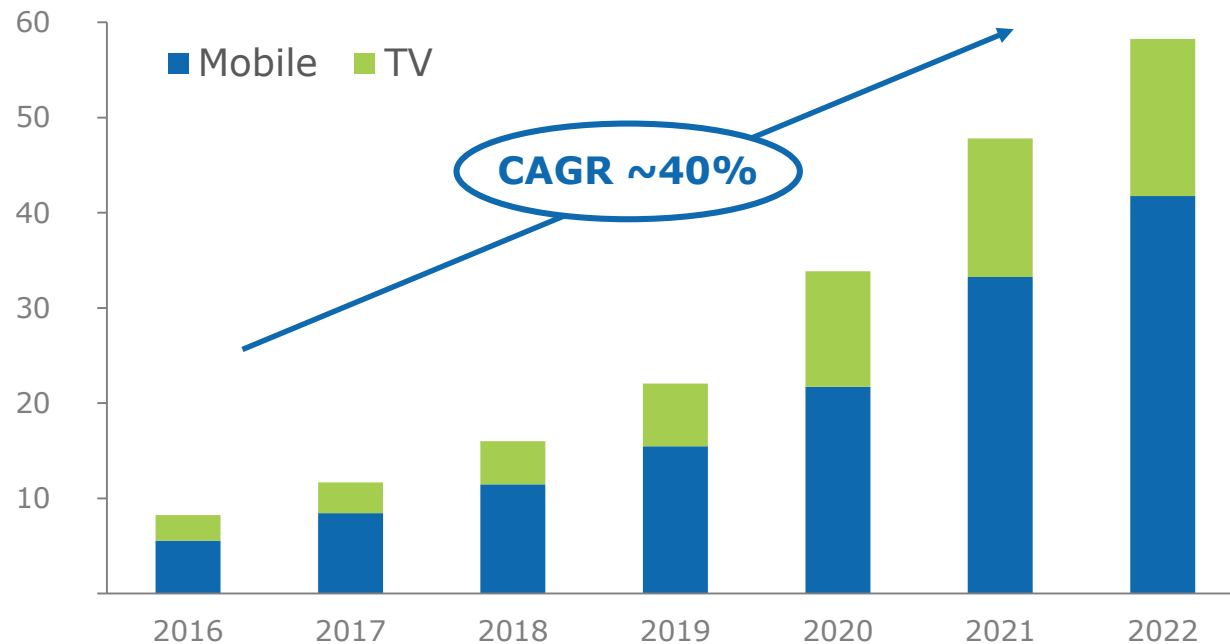
- Vol. growth < price decline
- Longer product life cycles
- Increasing competition
- Consolidation of customers

Performance Materials is the best owner of Liquid Crystals, which remains one of the most cash generative businesses within the Group

Illustration; Source: IHS, Merck KGaA, Darmstadt, Germany Market Intelligence
Abbreviation: CRT = Cathode Ray Tube; LCD = Liquid crystal display; OLED = Organic light emitting diode

OLED Materials and Photoresists are set to capture market growth

Announced OLED capacity expansion, [km²]*



strategy – capturing growth OLED

- Build on leading positions, established customers, application know-how & IP
- Expand into further stack layers
- Exploit market opportunities in China
 - OLED application lab in China

strategy – capturing growth Photoresists

- Leverage customer access to expand into other backplane process steps
- Maintain leading market position

Source : IHS amoled and lcd supply demand equipment tracker Q1 '18; *Capacity estimation based on 100% utilization and 100% yield; Abbreviation: IP = Intellectual property

Display Solutions remains partner of choice for the display industry

display

Market requirements



customer intimacy



solutions



speed



quality

display solutions

- Pioneer within the display materials industry
- Present in all relevant customer locations
- Long relationships with all panel manufacturers

- Long-term R&D collaborations drive enabling innovations
- Merck KGaA, Darmstadt, Germany enabled all LC display technologies

- Effective feedback cycles via local centers
- Modern, highly efficient and flexible production

- High-end on-site analytics
- Direct tests in device enable end-to-end quality control

Leading Market positions



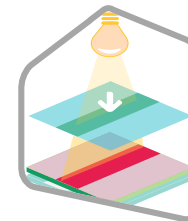
Liquid Crystals

#1 market leader and pioneer



OLED

Top 3

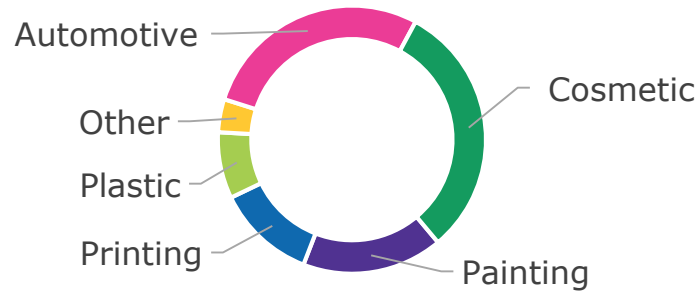


Photoresists

#1 market leader

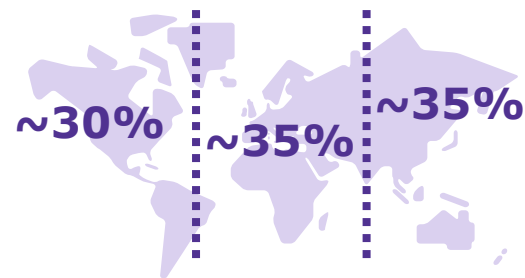
Surface Solutions – highly specialized and diversified product offering serves as a solid backbone with broad customer access

Industry footprint



- Diverse industry split
- Focus on lucrative niches
- >1,000 products

Geographic reach



- Well-balanced footprint
- Low dependency on country-specific cycles
- Production in U.S., EU and Asia

Global market access



- >6000 customers in 90 countries
- Effective multi-channel approach
- Dedicated key account management

Stability of business driven by industry, product and regional diversification

Strong customer relations drive value creating life cycle management

Market requirements



customer intimacy



solutions



speed



quality

surface solutions

- Global sales force with multi-channel platform
- Dedicated key account management
- Technical support on highest level

- Global innovation & application network
- Strong expertise in all relevant application fields
- Key enabler for enhanced surfaces

- Strategically located logistic and customer support centers
- Global flexible production network

- Customer-specific quality agreements, testing and release
- Industry-specific regulatory expertise

Leading Market positions



Automotive Effect Coatings
#1 market leader



Decorative Effect Pigments
Top 3



Functional Materials
Leading in niches



Performance Materials will return to growth

Business strategies

Semiconductor Solutions

Exploit market growth and leading positions of Semiconductor Solutions

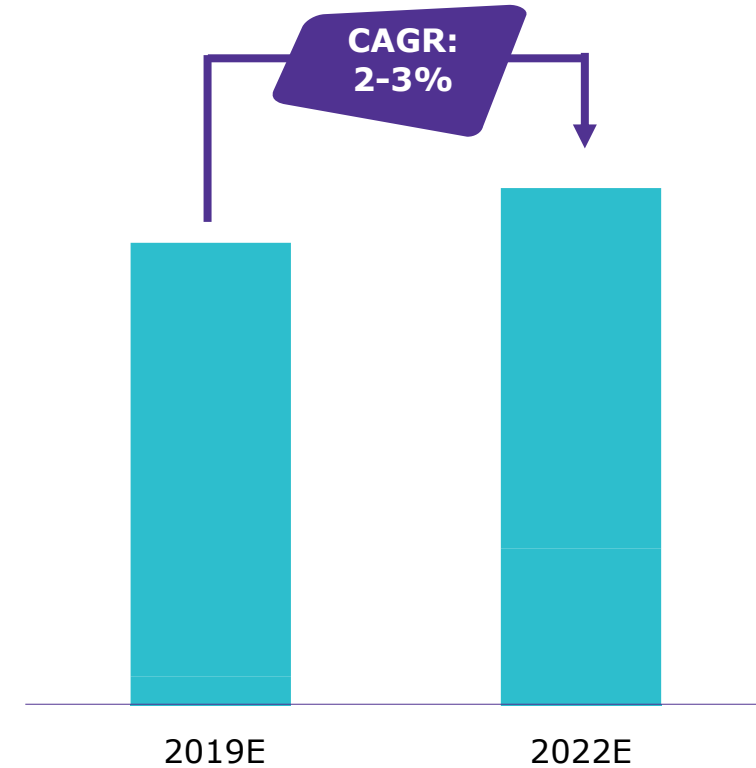
Surface Solutions

Drive value creating life cycle management through strong customer relations

Display Solutions

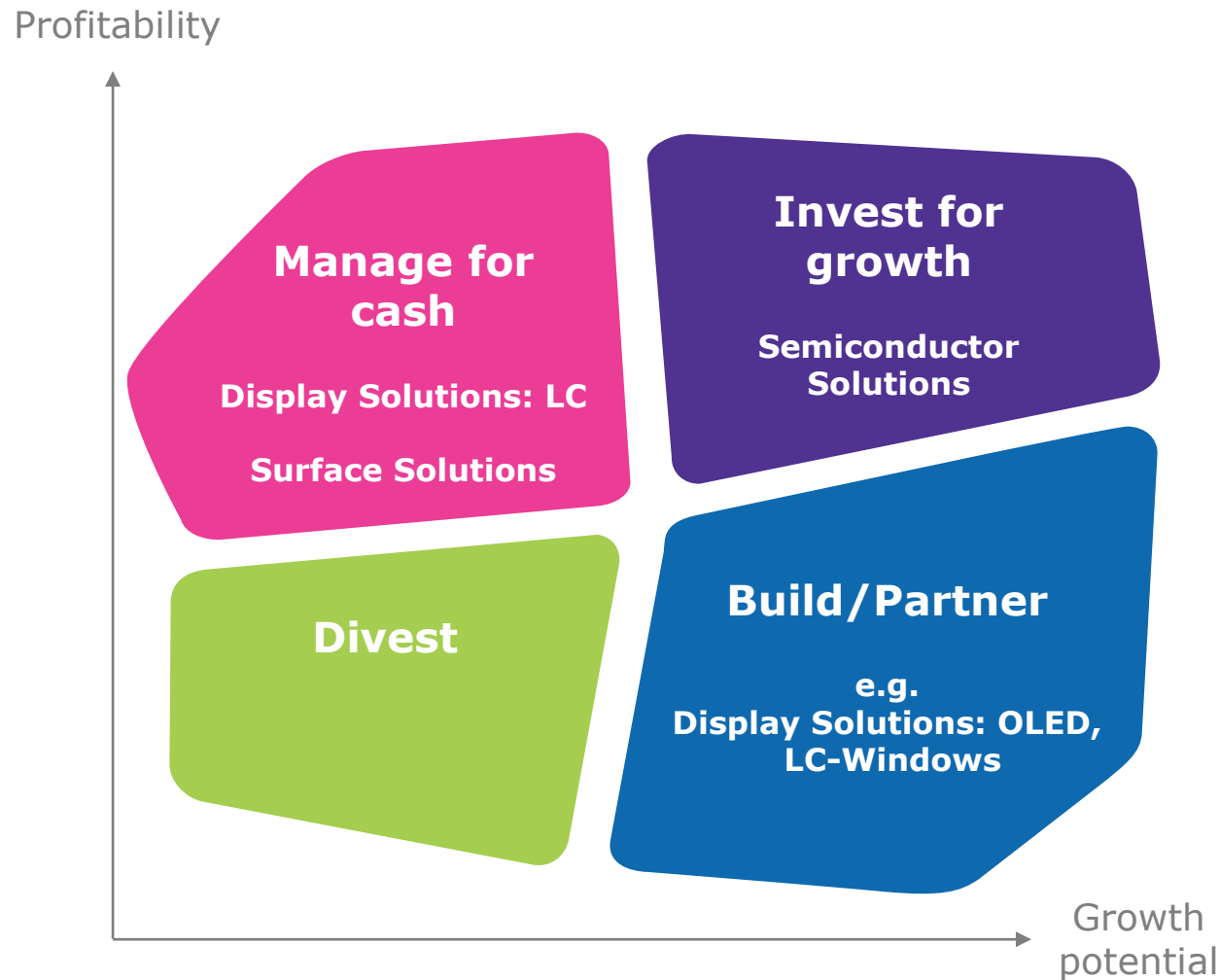
Manage LC and participate in OLED growth

Expected PM sales development





Business portfolio management drives capital allocation and enables future value creation



Invest for growth

- Strong and sustainable market growth
- Leading positions and attractive growth opportunities

Manage for cash

- Mature and lucrative market segments
- Invest in extension, while managing for profit

Build or Partner

- Early industry cycles with strong potential
- Strictly prioritize and diversify risk

Divest

- Regular review for better strategic owner

"Bright Future" 5-year transformation program drives long-term performance



Back to organic growth

- Exploit market growth of Semi & Surface
- Manage Liquid Crystal sales decline

- Refocus innovation and life cycle management
- Explore growth in adjacent technologies

2-3% CAGR

Resource allocation & process excellence

- Efficient reallocation/adjustment of resources

- Centralized early research approach
- Rigid R&D portfolio management

~30% Margin

Portfolio Management

- Continuous review of entire portfolio
- Evaluation of partnering approaches

- Consider inorganic growth options
- Drive solution based business models

Cultural change

- Foster customer-centric mindset
- Market-driven innovation
- Enhance a common Performance Materials spirit

Newly appointed management enables and accelerates change



NEW MANAGEMENT*

CEO
Kai Beckmann

- L1 almost entirely new
- 8 additional PM external hires
- 22 managers changed role
- Team diversity increased

Semiconductor Solutions
Anand Nambiar

Strategy & Controlling
Dorothea Wenzel

Display Solutions
Michael Heckmeier

Early Research & Business Development
Heidi Fagerholm

Surface Solutions
Friedhelm Felten

China
Allan Gabor



NEW STRUCTURE

+ Integrated & market-driven strategy





+ Resource allocation based on holistic R&D portfolio approach

+ Integrated supply chain addressing BU-specific needs

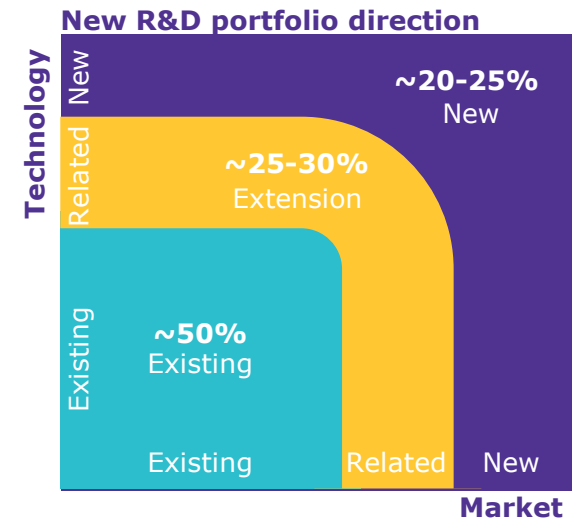
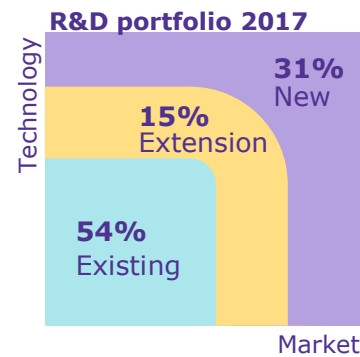
New R&D approach addresses evolving end-market requirements

1 Central portfolio management



-  Stage gated project assessment (go/no go)
-  Central resource allocation
-  End-market driven decision process
-  New risk adjusted pipeline assessment approach

2 Adjusting R&D investments towards extensions



Improve reliability and transparency for external communication

Performance Materials builds on its strengths to address the way forward

strengths



Customer intimacy



Solutions



Speed



Quality

way forward



Strengthened electronics market footprint



Accelerated growth in China



Agile resource allocation



Transparent & reliable communication

Performance Materials excites customers with innovative high-tech solutions



The high-end specialty chemical solutions provider



Focused on application-driven and customized solutions



Active in top-notch segments yielding attractive margins



Enabling customers to leverage market trends



Especially related to attractive electronics market

“Bright Future” to deliver upcoming milestones

1

Update on new PM strategy

July 2018



2

R&D pipeline update at Capital Markets Day

Q4 2018



3

Business-specific sales disclosure for Q3 2018 results

Nov. 2018



4

Back to sales & earnings growth

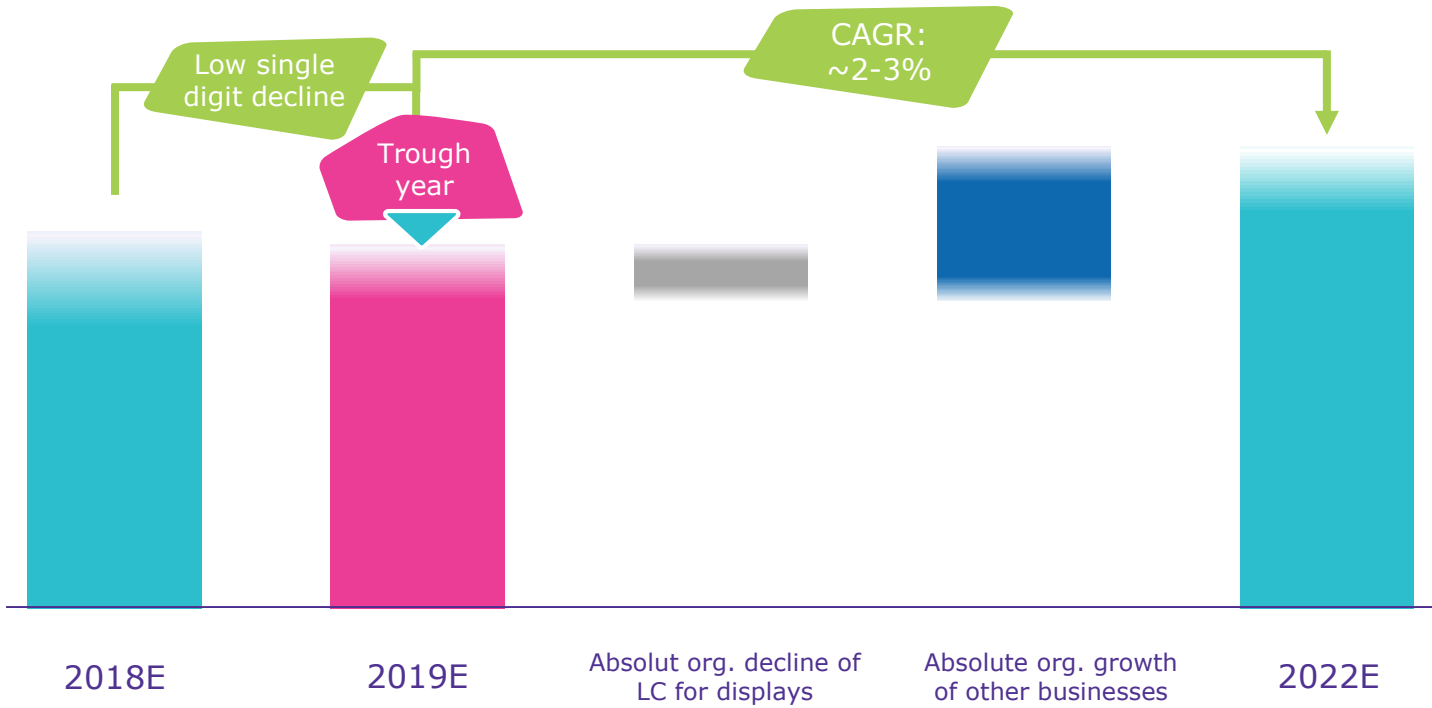
+2-3% CAGR
~30% margin

after 2019



Performance Materials will return to sales growth after 2019

Performance Materials sales development, in €m



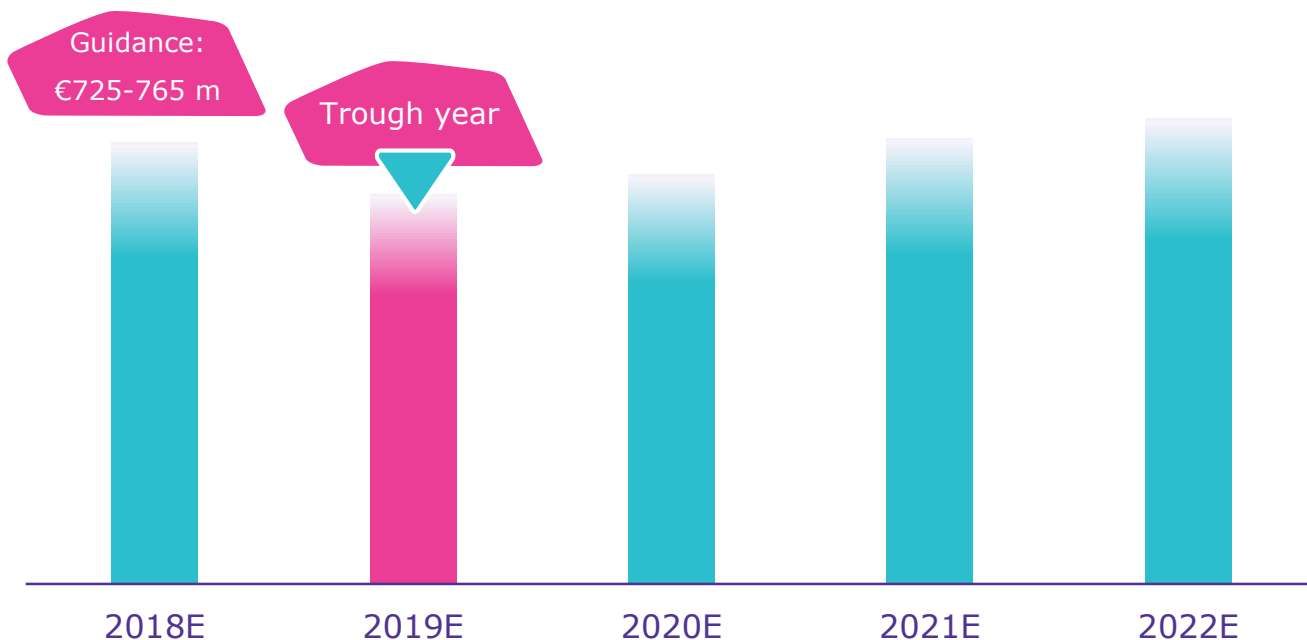
2019-2022 sales growth trajectory



After 2019 sales growth of Semiconductor & Surface Solutions, OLED and Photoresists will overcompensate the decline of Liquid Crystals for displays

Positive sales development drives earnings growth after 2019

EBITDA pre development



EBITDA pre development

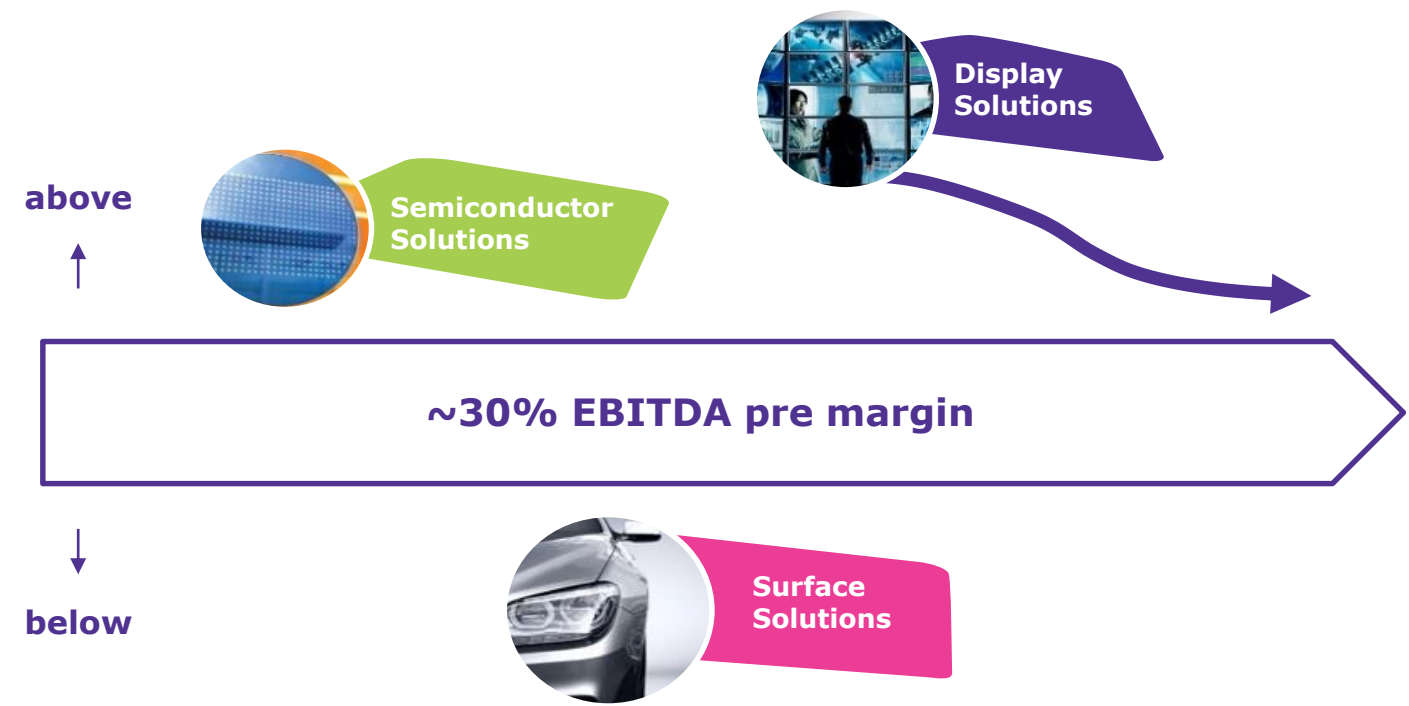
- After 2019, EBITDA pre will grow due to positive sales development
- Semiconductor & Surface Solutions will overcompensate for Display Solutions EBITDA decline after 2019

Margins of PM will remain around 30% in the long-run

profitability indication

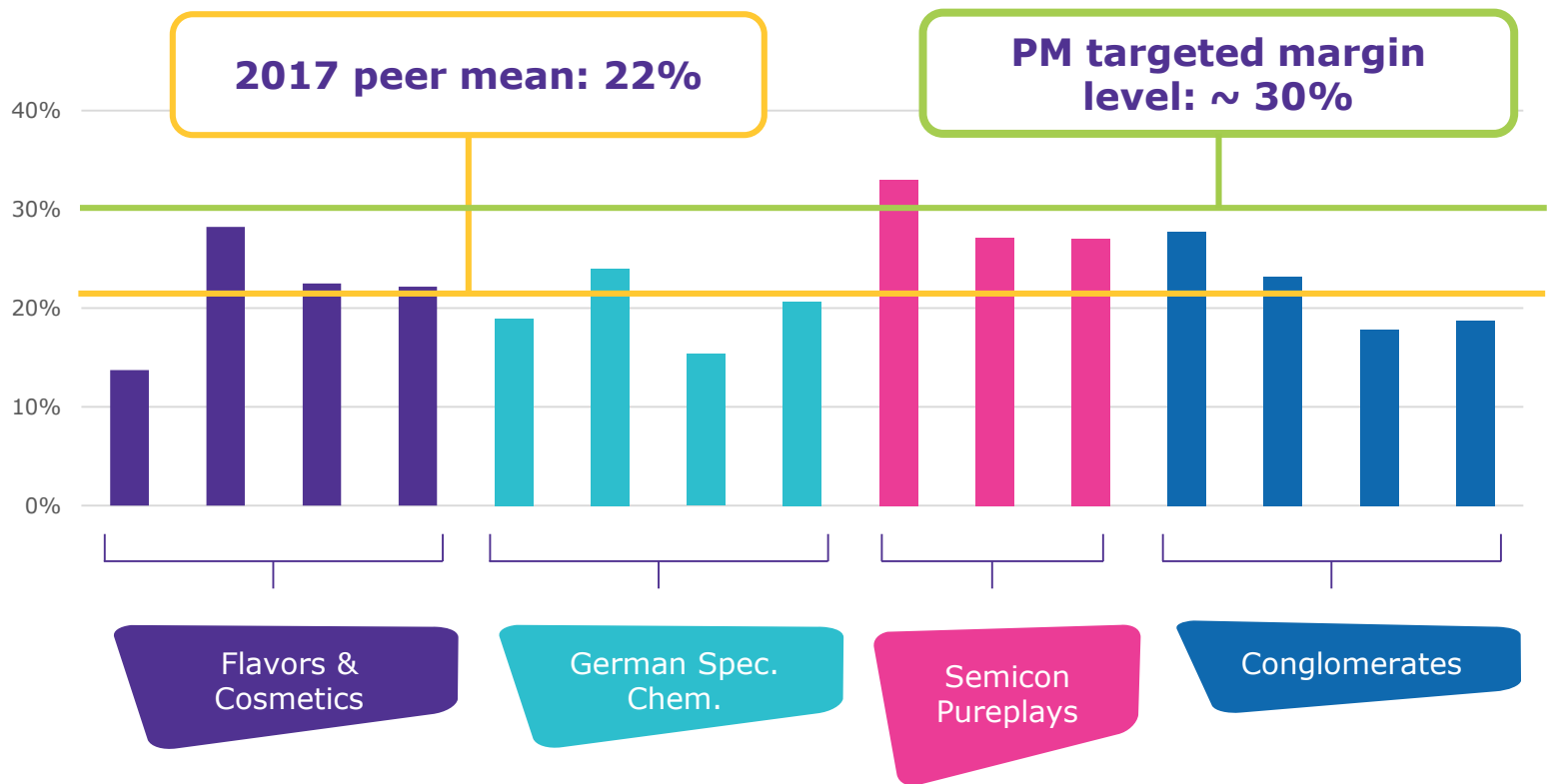
- Display Solutions will adjust towards PM average margin
- Bottom-line management to support margin
- Strong FX exposure will cause fluctuations

EBITDA pre margin indication by business



Performance Materials margins significantly above industry average

2017 EBITDA margins of various peer groups



Peer benchmark

- Extraordinary situation of past years is adjusting
- Future profitability will remain very attractive compared to specialty chemicals
- Benchmarks well against several peer groups

Profitability will remain above specialty chemicals average

Group on a growing and profitable trajectory

2019 GROUP EBITDA pre increase confirmed

2019

2018

Sales



Sales

EBITDA pre



EBITDA pre

Margin



Margin

Merck to return to profitable growth track from 2019 onwards

FY 2017 results presentation



EBITDA pre growth from accelerated top line growth and disciplined cost management



EBITDA pre growth driven by above-market growth and further margin expansion from operating leverage



Trough year for EBITDA pre and focus on strategy execution



High confidence to deliver sales and EBITDA pre growth as well as EBITDA pre margin improvements



37



Healthcare and Life Science will compensate for Performance Materials' trough year

Conclusion



Well positioned in the attractive electronics market



Long-term growth perspective with an average annual growth of 2-3%



Back to earnings growth in FY 2020



Margin of around 30%, significantly above specialty chemicals peer average



Highly cash generating business & valuable pillar within the group

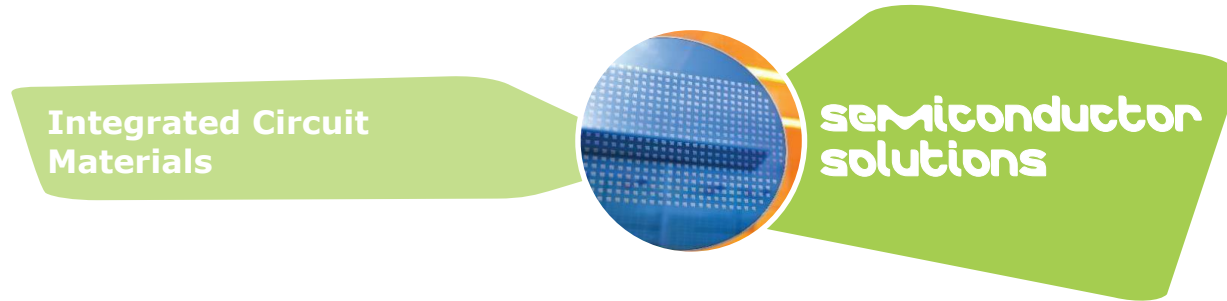






Performance Materials: New structure combines LC with OLED, serving same customer group

Business allocation within Performance Materials



% sales



Products

- Dielectrics, colloidal silica, lithography materials, yield enhancers, edge-bead removers
- Polyimide raw materials and printing materials



- Liquid crystals (LC) and photoresists for TVs, smartphones and tablet computers
- Other display and non-display applications (e.g. LC Windows)
- Organic and inorganic light emitting diodes



- Effect pigments and functional materials for coatings, plastics, printing and cosmetics
- Functional materials for cosmetics & special applications
- Functional materials for electronics and energy solutions

Enabler of key technology trends



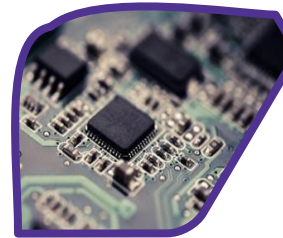
Lithography materials

Innovation focus: Enabling structures in nodes smaller than 14 nm



Dielectric materials

Enabling cost-efficient production of the newest memory generations



Conductive Pastes

Electrically conductive materials for use in the manufacture of advanced electronic devices

Newest generation of smartphones



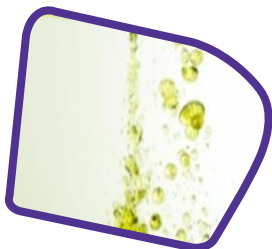
Servers enabling Big Data



Wearables and other devices for Internet of Things



- Smaller structures by materials enabling Moore's law
- Higher memory capacity, faster processing speed, less power consumption
- Improved yield and lower processing costs



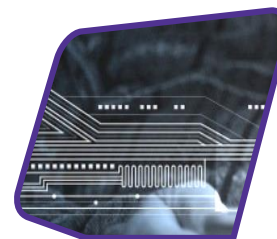
Process materials

Supporting the manufacturing process for all kinds of IC devices, e.g. IoT



Silica materials

Innovation focus: High removal rate in CMP without defects



Deposition Materials

Next Generation Deposition materials for ALD and CVD

Overcoming technology barriers – supporting continued progression of technological mega trends

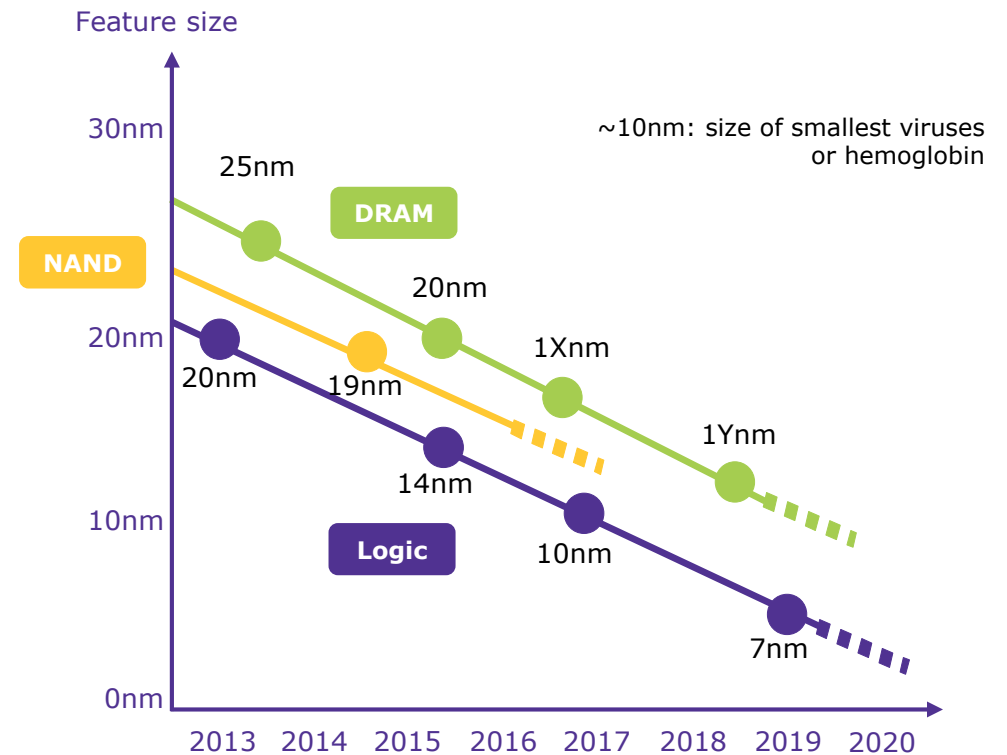
Technological trends

- Increasing customer needs for performance, cost and energy efficiency have been achieved by ongoing miniaturization of feature sizes according to Moore’s law. This trend is expected to continue – but at a slower pace
- Current market trends such as mobility, big data, and the Internet of Things will lead to increasing demand in semiconductors but they also require more specialized solutions, as they focus on distinct applications
- Tighter specifications and innovations close to physical boundaries lead to increasing requirements for suppliers of the semiconductor industry
- This leads to favorable market conditions for companies with deep process expertise and high specialization as well as technological advanced companies like us

New technologies need to be developed to further decrease feature size:

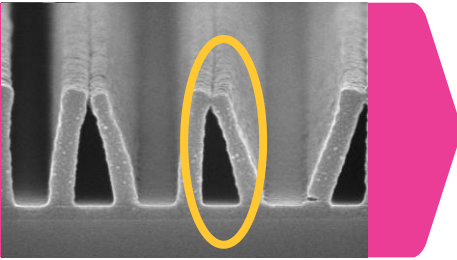
- DSA (directed self-assembly) strong position for Group
- EUV-Lithography (extreme ultra-violet) and multiple patterning – we offer a portfolio of specific enabling materials (e.g. EUV rinse)

Feature sizes in memory market develop as predicted by Moore’s law¹

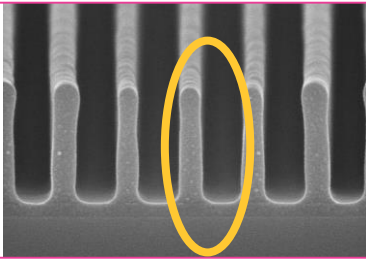


Semiconductor Solutions develops dedicated solutions for customer challenges, enabling cutting edge innovation

Pattern collapse

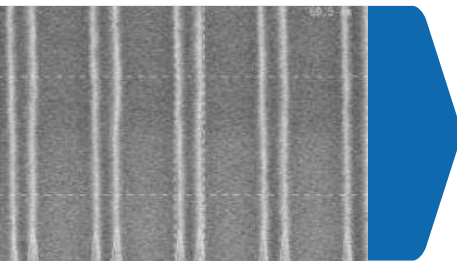


Firm[®] rinse materials




- As lines get narrower and closer together in advanced chip generation, they tend to “stick” due to surface tension.

Lithography limitation

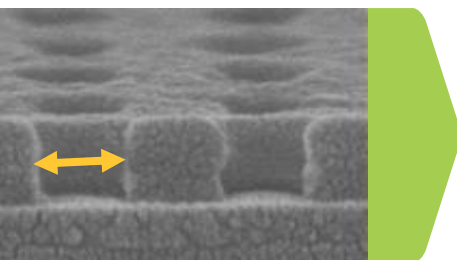


Directed self assembly (DSA)

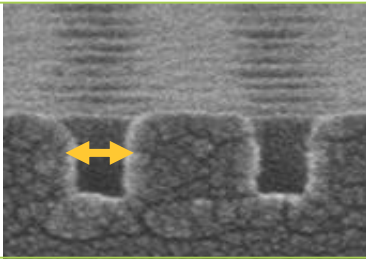


- Block Copolymer can generate small lines or contact holes by self-assembly. This allows miniaturization without expensive new equipment.

Wide features



Relacs[®] shrink materials



- Shrink materials “shrink” the gap between lines and, hence, allow the manufacture of narrower features otherwise not possible

Developing specific display solutions for the ambitious needs of our customers



Liquid crystals

- For LCD televisions, monitors, cellphones, and notebooks
- Each new application needs customer-specific LC mixture
- Includes top technologies such as IPS, PS-VA (polymer-stabilized vertical alignment) and UB-FFS (ultra-brightness fringe field switching)

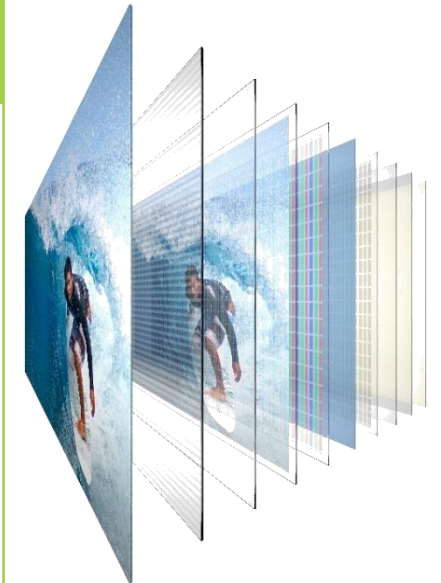


LC materials for liquid crystal windows (LCW)

- Extremely fast, continuous switching between light and dark state
- Customized color variation
- Energy autonomy
- Simplicity in production, design, installation and use
- Excellent integration
- LCs with top UV stability

Photoresists

- Materials for flat panel display processes
- Technology and market leader in Photoresists for display manufacturing (LCD and OLED)
- High resolution and other specialized resists for optimized process and performance
- New high-stability siloxane polymers for dielectric and backplane electronics



Broad portfolio of Decorative Solutions to offer new opportunities in enriching customers' products

Applications

Car coatings



Industrial coatings



Printing



Plastics



Architecture



Color cosmetics



Food & pharma



Design



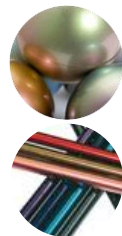
Brands

Cosmetics



- Timiron®
- Colorona®
- Xirona®
- RonaFlair®
- Ronastar®

Industrial applications



- Colorstream®
- Xirallic®
- Miraval®
- Biflair®
- Meoxal®

Food & pharma



- Iriodin®
- Pyrisma®
- Thermaval®



Candurin®

Decorative Materials

- Developing and marketing innovative effect pigments for various application areas
- Most important target markets include the coatings industry focused on automotive application, the plastics industry, printing companies and cosmetics manufacturers
- Continuous effect pigment innovations offer our customers new opportunities to continuously upgrade their product designs with striking hues and effects.

Functional Solutions offers a wide portfolio to fulfill very specific industry needs

Functional Solutions

- Developing and marketing functional pigments and additives that offer practical advantages and specific additional benefits for coating manufacturers and plastics and printing industries
- Effects include electrical conductivity, solar heat management and counterfeit prevention
- Offers cosmetics manufacturers functional solutions for skin care and protection

Applications

Personal care



Laser marking



Security



Coating & Printing



Brands

Light protection



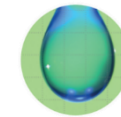
Eusolex®
Oxynex®

Insect Repellents



IR3535®
IR88®

Surfaces



Tivida®
Durazane®

Security



Colorcrypt®
Colorcode®
Securalic®
Lustrepak®

Skin perfection



RonaCare®
RonaFlair®

Laser marking



Iriotec® 8000

Conductivity/ heat management



Iriotec® 7000
Iriotec® 9000

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