

**Color Concentrates**



## Agenda

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- Introduction to LyondellBasell
- Advanced Polymer Solutions and Color Concentrates in Europe
- Color Concentrates Product Line
- Sustainable Product Solutions

# LyondellBasell is a strong, global company delivering outstanding performance

## LEADING<sup>(1)</sup>

#1

Producer of **polyethylene** in Europe  
Producer of **polypropylene** in North America and Europe  
Producer of **oxyfuels** in North America and Europe  
Producer of **polypropylene compounds** globally  
Licensor of **polyolefin technologies** globally

## DIVERSE



Many of our **materials** go into products that people use every day, such as food packaging, electronics, children's toys and fuels.

## GLOBAL



Every day, our **employees** work around the clock to safely **advance solutions** to our world's biggest challenges.

## GROWING

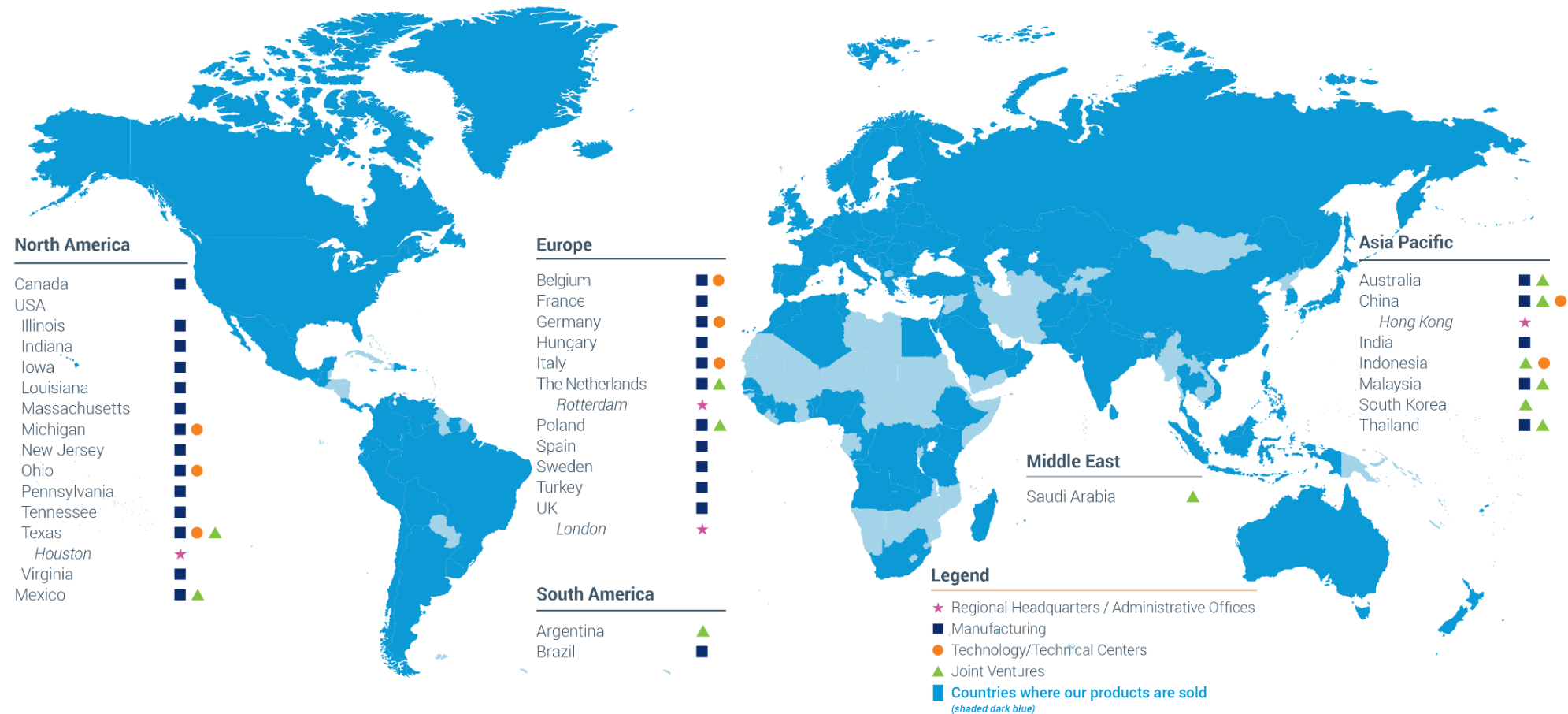


Increased U.S. ethylene capacity by **23%** since 2012  
Building the first world-scale **Hyperzone HDPE plant** and world's largest **PO/TBA plant**  
Acquired A. Schulman, expanding our position in the **advanced polymers markets**

One of the world's largest plastics, chemical and refining companies producing products and materials key to advancing solutions to modern challenges

<sup>(1)</sup> 2018 data as of December 31, 2018

# LyondellBasell has the scope and scale to serve global markets



**We manufacture and have joint ventures in 24 countries  
Our products are sold in more than 100 countries**

Note: Map is as of December 2018

# LyondellBasell delivers innovative products and solutions in five key areas



## CHEMICALS

We produce the chemical building blocks for:

- automotive fluids
- furniture / household goods
- coatings / adhesive / cleaners
- cosmetics / personal care products



## POLYMERS

Our versatile plastic resins are used to create a variety of products including:

- automotive parts
- packaging
- piping
- textiles
- renewable energy technologies
- agricultural films / irrigation
- healthcare
- food supply products



## ADVANCED POLYMERS

Our diverse portfolio is used to create customizable products including:

- automotive parts
- differentiated packaging
- electronics / appliances
- construction materials
  - roofing
  - flooring
  - geomembranes
  - specialty pipe



## FUELS

Our refinery in the U.S. produces:

- gasoline / fuel components
- low-sulfur diesel
- jet fuel
- lubricants
- oxyfuels that help improve air quality



## TECHNOLOGIES

We license our state-of-the-art manufacturing and process technologies:

- technologies that are used by chemical and plastics companies around the globe

# Our products are advancing a range of solutions in nearly every geography and sector of the economy



## Food safety & access

Food packaging and films that improve freshness, portability and extend shelf-life



## Sustainable & modern living

Materials that form components used in solar panels, wind turbines, children's toys, cosmetics, leak- and shatter-proof containers



## Cleaner air & fuel efficiency

Stronger, lighter plastics support increased fuel efficiency



## Clean water

Stronger, longer-lasting pipes used in municipal water systems and key elements used in water filtration systems



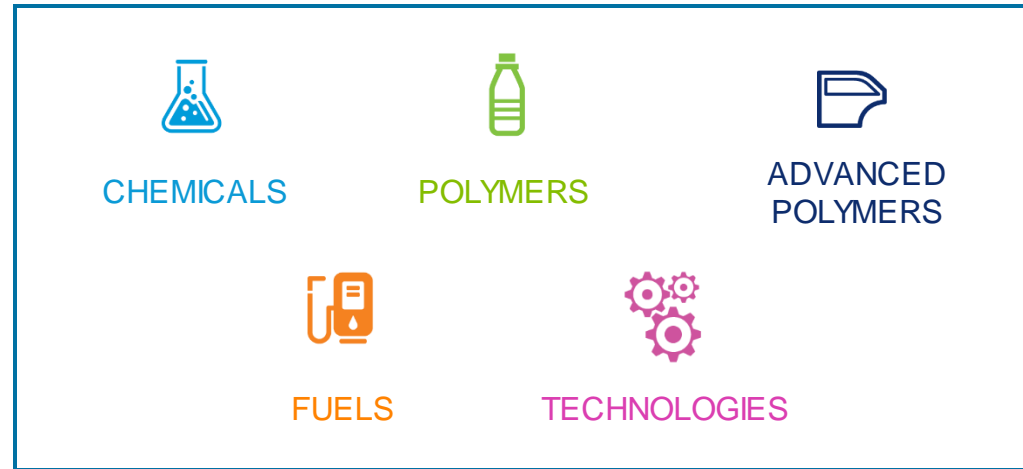
## Quality healthcare

Improved medical supplies such as synthetic latex gloves, hand sanitizers, biohazard bags and pill coatings



## Agricultural efficiency

Lighter machinery, crop protection and soil conditioning used to be more efficient in agroprocessing



# Innovation Capabilities

## PROCESSING

- Lab Scale Compounding
- Cast Film
- Blown Film
- EBM
- Injection Molding
- Rotational Molding
- Thermoforming
- Tape Extrusion
- Banbury Mixer
- Sheet Lines
- Filter pressure tests
- Blow molding
- Screw design software



## PERFORMANCE

- Weathering
- QUV chambers
- Gas Fade Chamber
- COF
- Blocking Force
- Seal Strength
- Seal Initiation Temperature
- Elmendorf Tear
- Tensile/Elongation
- Flexural Modulus
- Charge Decay Time
- Surface Resistivity
- Humidity Chamber
- Instrumented Impact
- Falling Dart Impact
- Heat Deflection Temp
- Glow Wire
- UL 94 Flame
- Plasticizer Extraction
- Microwave Ashing
- KF & LIW Moisture
- Fogging Tester

## APPEARANCE

- Color Spectrophotometer
- UV-vis-NIR Spectrophotometer
- Haze Meter
- Gloss & DOI Meter
- Polarized Light Microscopy
- Sheffield Smoothness
- Ink Rub Test
- Five-Finger Scratch
- Cross Scratch
- MAR Scratch



*Summary is intended to be indicative of overall capabilities and is not a complete list. Capabilities vary by region.*

## ANALYTICAL

- Gas Chromatography
- Gel Permeation Chromatography
- High-Pressure Liquid Chromatography
- Nitrogen Analysis
- Differential Scanning Calorimetry (DSC)
- Thermogravimetric Analysis (TGA)
- X-Ray Fluorescence
- FTIR/ATR Microscope
- Dynamic Mechanical Analysis (DMA)
- Thermomechanical Analysis (TMA)
- Parallel Plate Rheometer
- Research Capillary Rheometer
- N<sub>2</sub> and O<sub>2</sub> Permeation
- Polyamide Solution Viscosity
- SEM-EDX (energy dispersive)
- XRF (wavelength dispersive)
- UV-VIS Spectroscopy
- GC-MS

## Addressing megatrends with innovative solutions



### Urbanization

- Engineering more energy-efficient materials
- Materials to help developers meet LEED certifications
- Focusing on responsible stewardship through recycling and re-use



### Evolving Consumer Demands

- Enabling shift from rigid to flexible packaging
- Minimizing food waste through solutions that provide extended shelf life
- Product protection for increasingly complex supply chains



### Lightweighting

- Driving system integration through parts consolidation
- Increasing fuel efficiency via lighter, stiffer material solutions
- Unique filler content that improves performance while reducing weight



### Sustainability

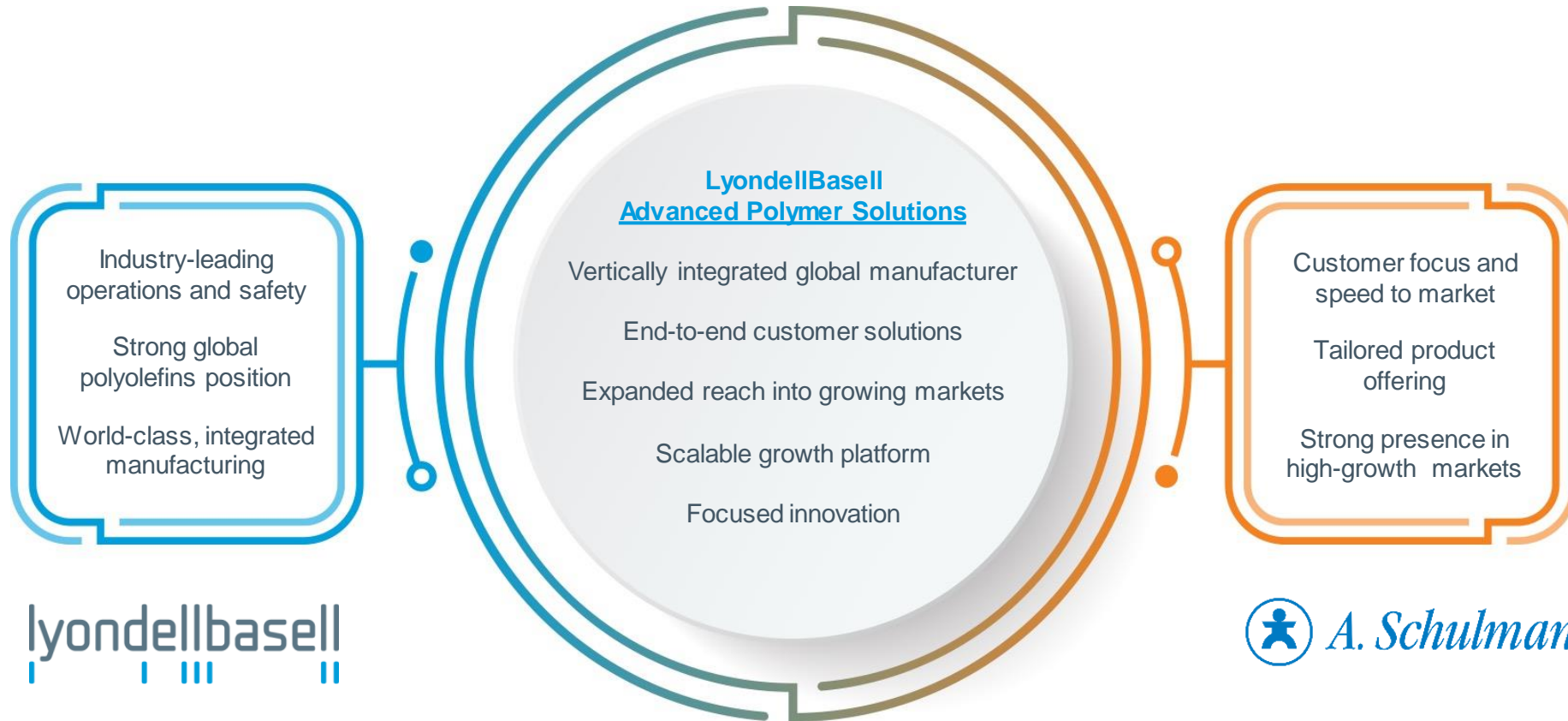
- Manufacturing materials that can be recycled
- Providing materials that can withstand long-term use
- Incorporating renewable content, such as bio-based materials



## **Advanced Polymer Solutions**

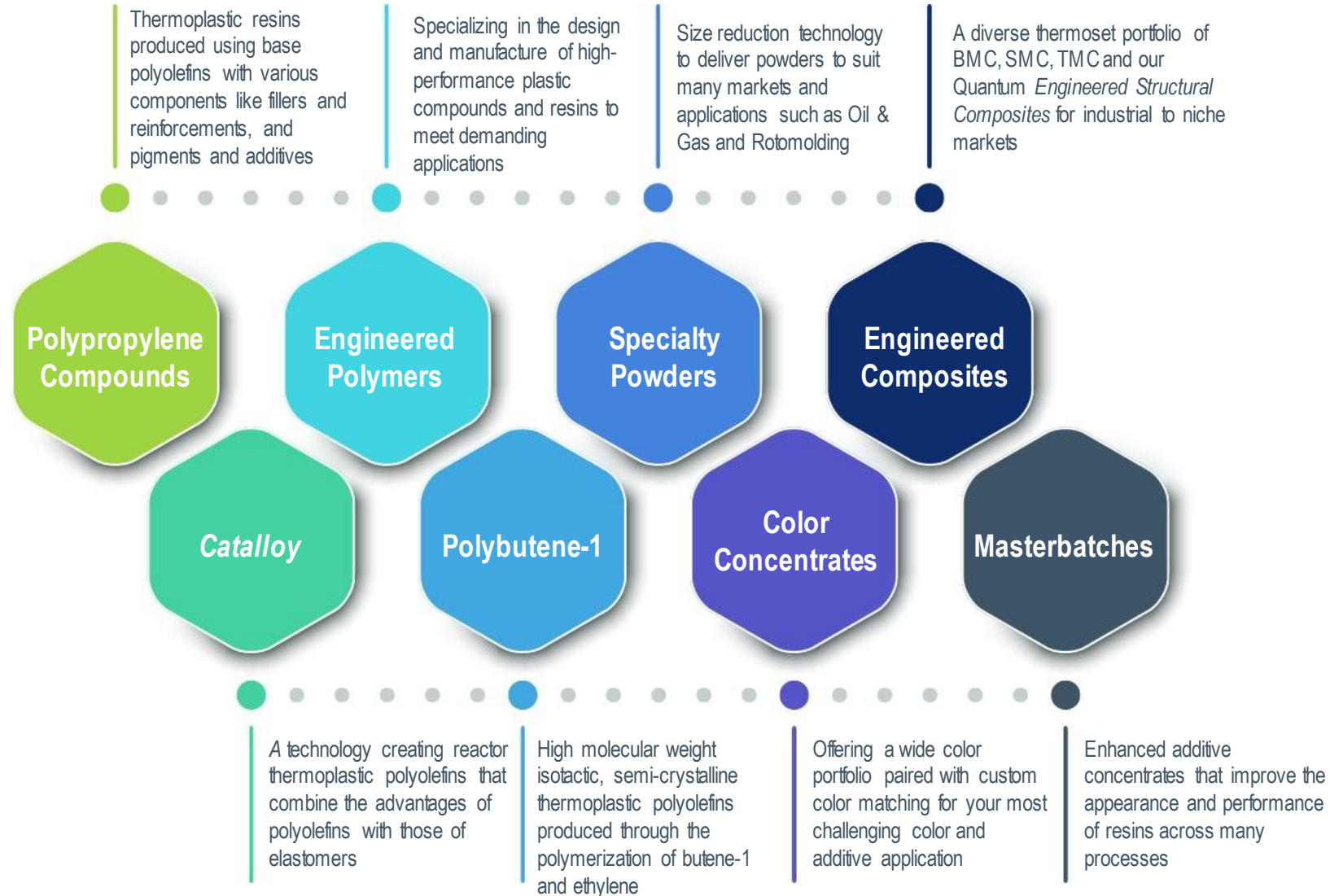
Custom Performance Colors - Color Concentrates

## Complementary strengths deliver complete solutions to customers

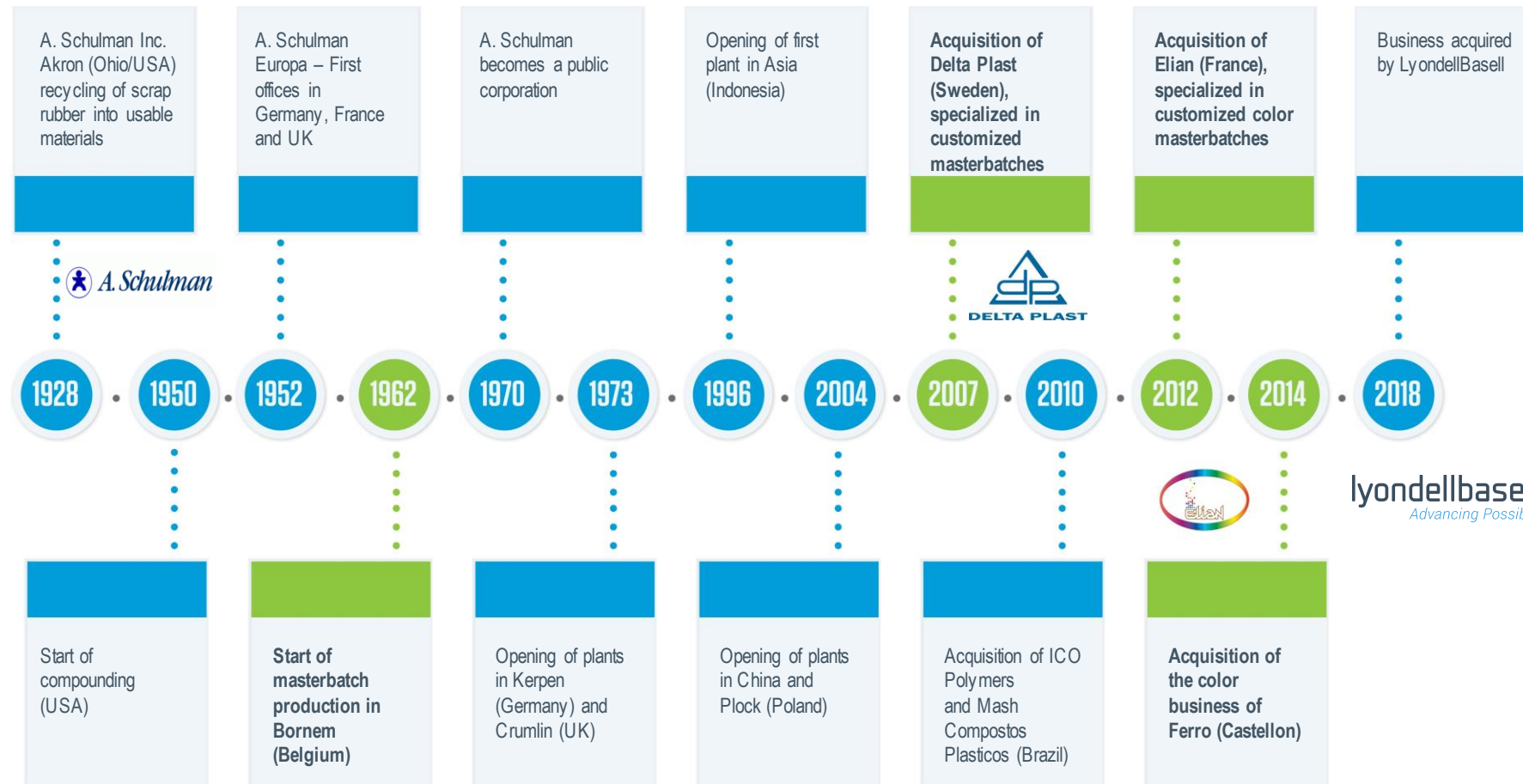


# Advanced Polymer Solutions product portfolio

LyondellBasell delivers innovative solutions through our key material technologies:







# Color Concentrates History- Passion for Plastics for 95 years

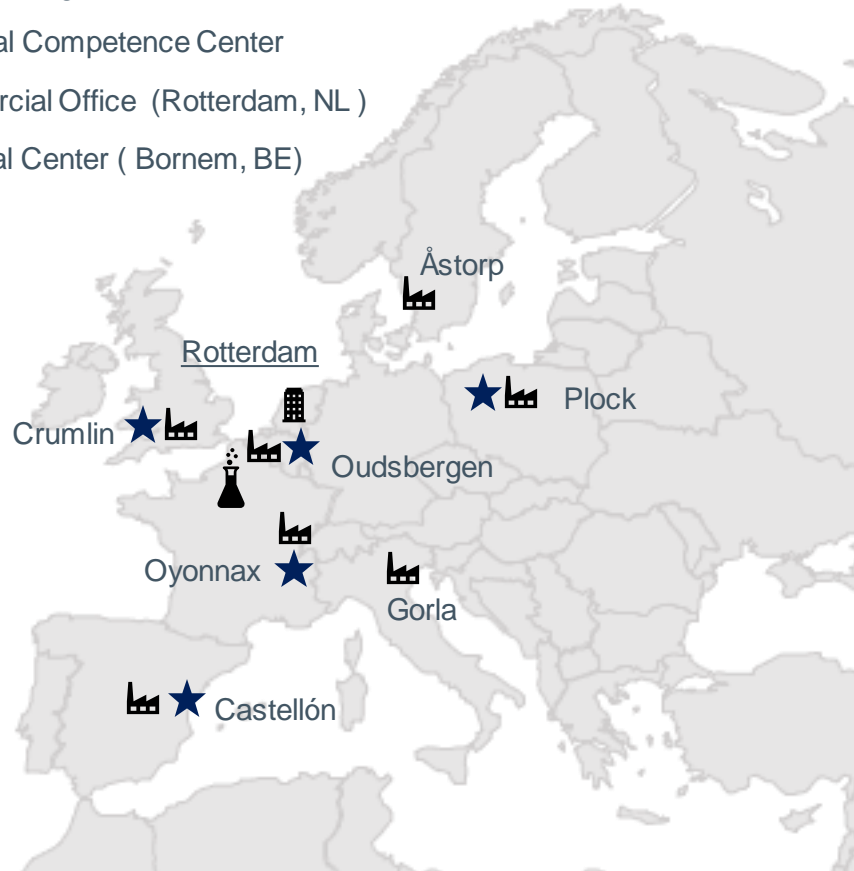


# LyondellBasell - Global Color Concentrates Asset Footprint



# Color Concentrates in Europe- The Color Network

-  Manufacturing Plant + Color Lab
-  Technical Competence Center
-  Commercial Office (Rotterdam, NL)
-  Technical Center (Bornem, BE)



- **Seven Color Masterbatch Plants**
- **Standardization across plants**
- **ISO certification**
- **Audited by different brand owners**
- **Specialization in different polymers**

## Competence Centers

- |                          |                      |
|--------------------------|----------------------|
| ▪ Automotive             | Plock                |
| ▪ Rigid Packaging        | Oudsbergen           |
| ▪ Agri                   | Castellón            |
| ▪ Color of recyclates    | Castellón            |
| ▪ Special effects/ Pearl | Plock                |
| ▪ Monos                  | Crumlin              |
| ▪ POC & Fibers           | Crumlin / Oudsbergen |
| ▪ PVC                    | Oyonnax              |
| ▪ UL                     | Gorla                |
| ▪ POM                    | Gorla                |
| ▪ Biopolymers            | Gorla                |

# Masterbatch & Color Concentrates

## POLYMERS

- PP (HP, ICP, RCP)
- PE (LDPE, LLDPE, HDPE)
- EVA, EBA, EMA
- GPPS, HIPS, ABS, SAN
- PET, PETG, PCTG, PCTA..
- PVC
- PA, Nylon
- PLA, PHA, modified starches
- Bio-resins
- Post Consumer ( ex QCP)
- rPP, rPE
- ...



## ADDITIVE TECHNOLOGIES

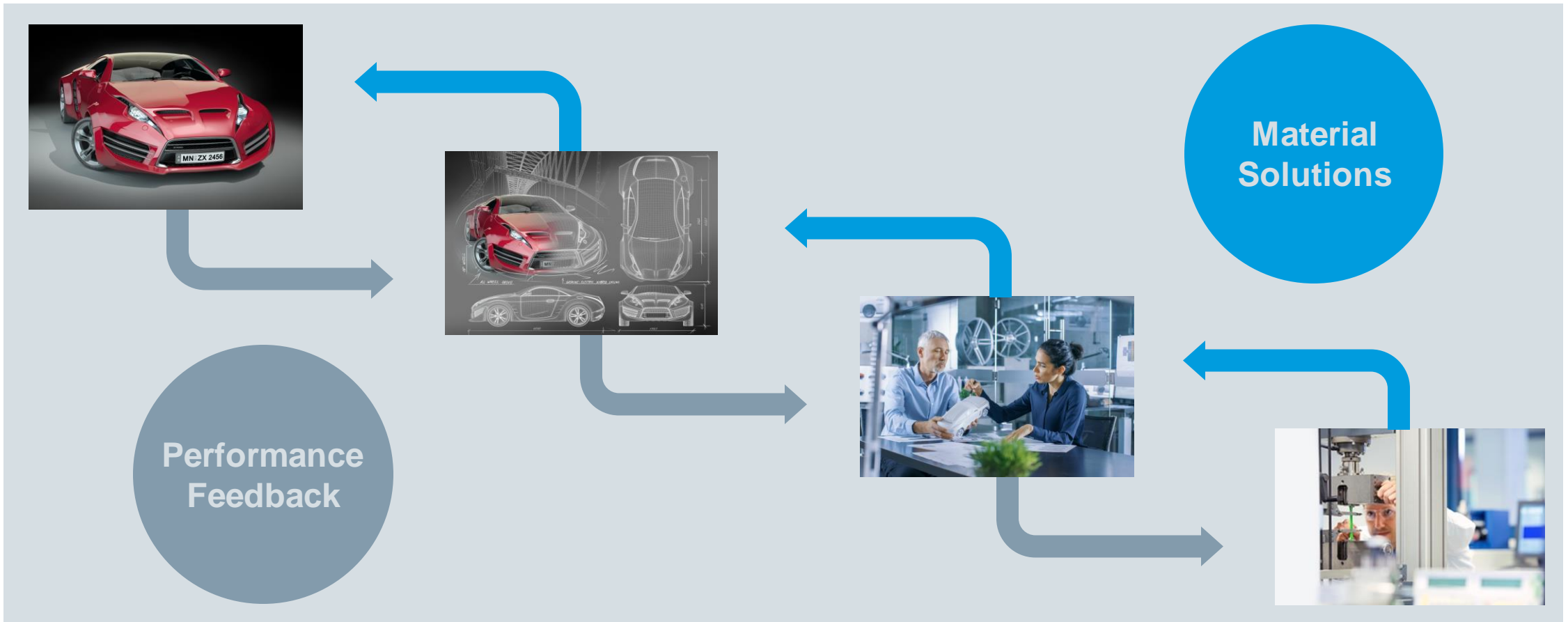
- Polybatch Colors*
- Standard Colors
  - Customized Colors
    - Tailor made
    - Special effects
    - Sustainable solutions
  - *Polyblak* Black
  - *Polywhite* White
  - *Polybatch* Additives:
    - Antiblocks
    - Antifogs
    - Antistatics
    - Light manipulation
    - Matte compounds
    - Mineral fillers
    - Nucleators
    - Processing aids
    - Slip / Antislips
    - UV Stabilization, etc.



## BENEFITS

- Enhanced aesthetics
- Color matching and trending
- Technical solutions for organoleptic, warping...
- Functional batches- Colour and Additives as 'One-Pack Solution'
- Improved processing and output
- Tailored performance and functionality
- Enhanced barrier technology
- Manipulation of surface properties
- Stabilization of regrind/recycled resins

# Innovation Cycle



**Collaborative approach ensures solutions meet customer needs in required timeframe**

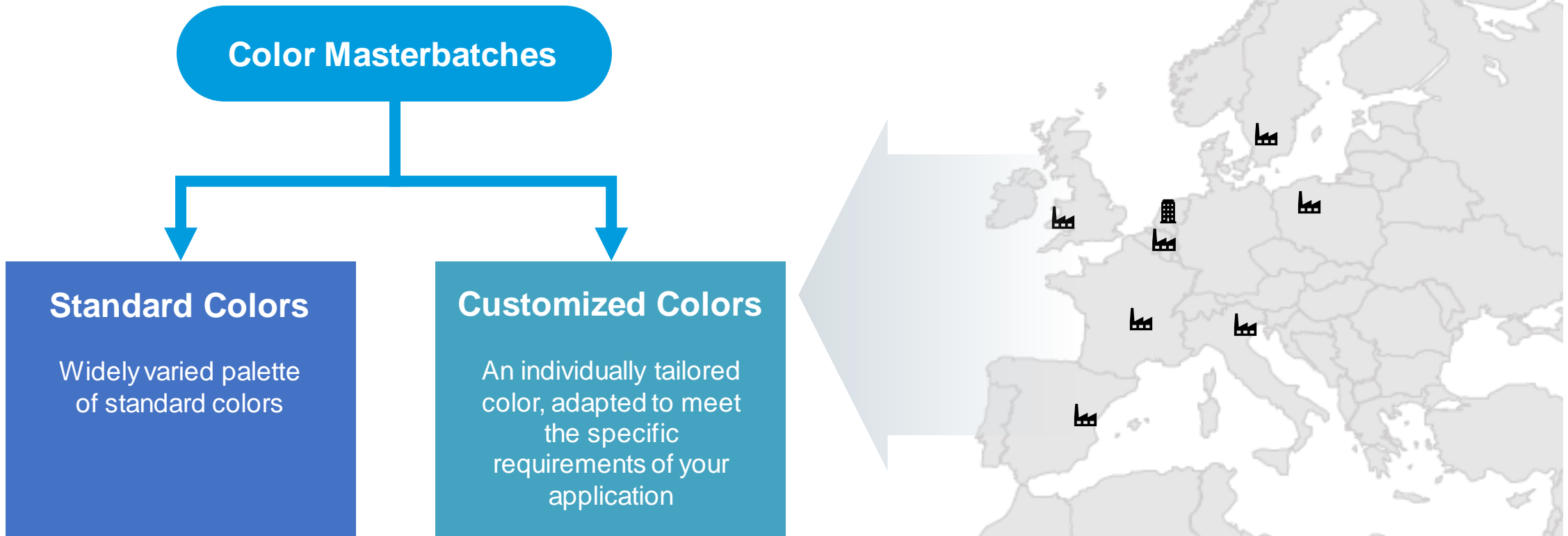


## Color Concentrates

Product Portfolio

## Color Concentrates Product Portfolio

Your products in the color of your choice



## Color Concentrates Product Portfolio

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Standard Colors -  
*Polybatch*

Customized Colors -  
*Polybatch*

- Tailor made color masterbatches
- Sustainable solutions
  - NIR detectable colors
  - Renewal sources
  - Post-consumer based sources



# Typical markets and applications

## Masterbatch & Color



### Packaging

- Flexible & Rigid
- Food & Beverage
- Personal Care
- Cosmetics
- Household and Industrial
- Labels & Tape
- E-Commerce



### Building & Construction

- Roofing Films & Membranes
- House Wrap
- Pipe & Drainage
- Architectural Films
- Signage & Banners



### Agriculture

- Greenhouse Films
- Crates
- Mulch Films
- Silage & Bale Wrap
- Aquaculture
- Geomembranes



### Transportation

- Automotive
- Marine
- Recreation
- Protective Films



### Consumer Goods

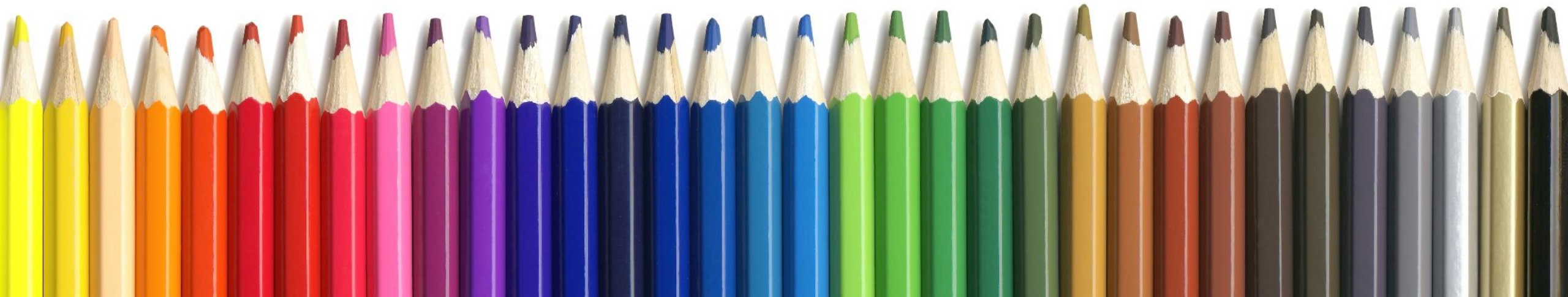
- Diapers
- Shampoo Bottles
- Kitchen Utensils
- Furniture
- Stationary
- Toys



### Appliances

- Refrigerator Liners
- Washers & Dryers
- Handheld Tools
- Electronics
- Display & Protective Films

## Standard Colors



## Standard Color Masterbatches

Standard colors produced  
“Made-to-Stock”

67 different colors available

High quality and available from stock  
for immediate despatch from 25kg+

Cost effective solution for Polyolefin  
coloration

Broad range of Polyethylene



## Standard Color Masterbatches

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- Applications
  - **Flexible (Film):**
    - High dispersion quality
    - Addition rate typically 5-10%
  - **Rigid (Thick Wall):**
    - Injection / blow moulding, sheet extrusion etc
    - Addition rate typically 1-2%



## Customized Colors





## Customized Color Masterbatches

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- Colors for a broad range of industries
  - Packaging
  - Building & Construction
  - E&E
  - Agriculture
  - Mobility
  - Sports & Leisure
  - Personal Care & Hygiene
- **Tailor made ‘in any color you can imagine’**
- **Developed and produced in 7 locations in Europe**
- **Made to Order, available from 5 kg up to full truck loads**



## Customized Color Masterbatches



### Wide range of polymers available

- All polyolefines
- Olefin copolymers
- Styrenics
- Technical polymers ( PET, PETG, POM..)
- Thermoplastic elastomers
- PVC ( rigid and plasticized )
- Renewal sources
- Postconsumer based sources and regrind materials

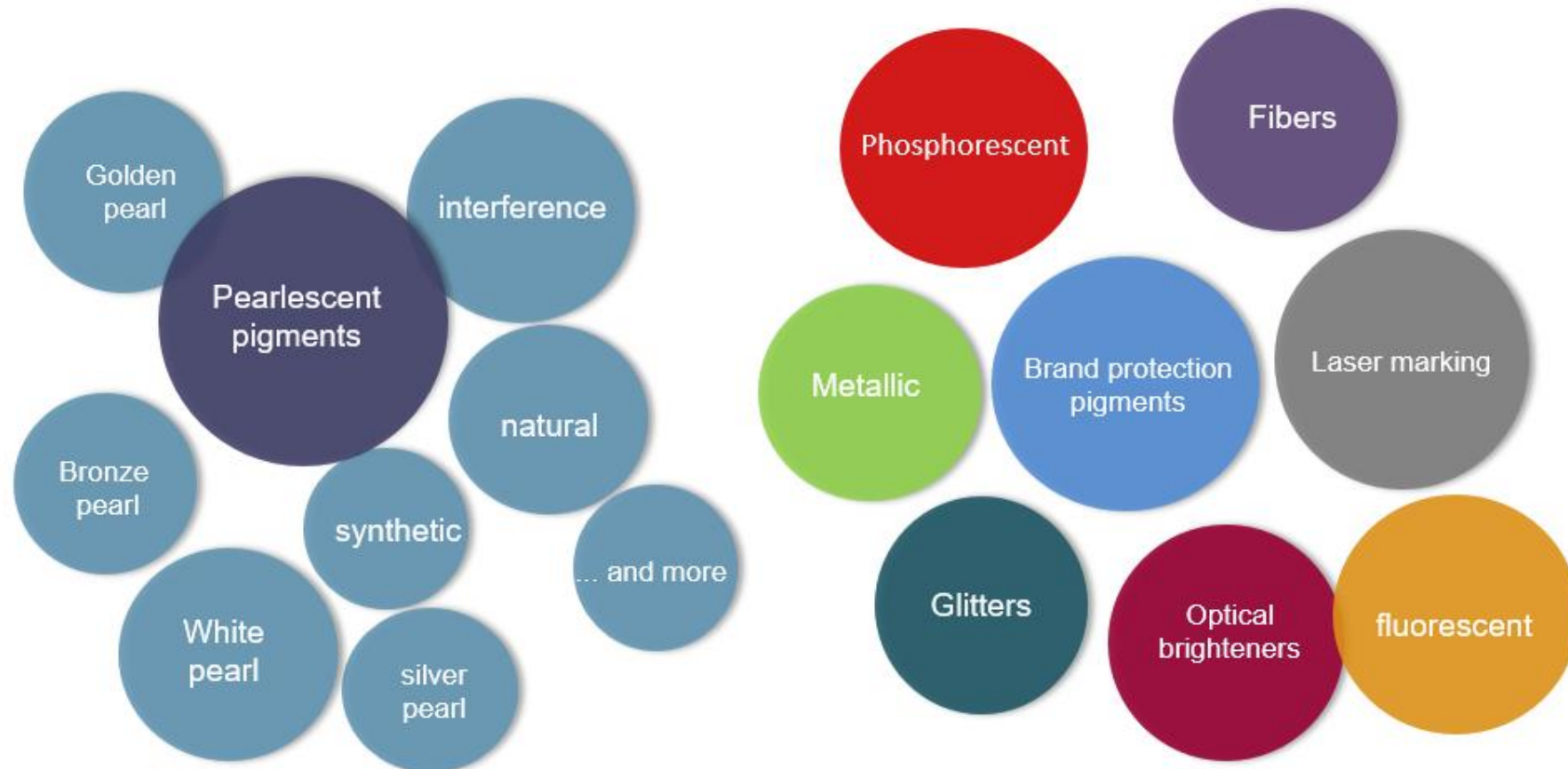
## Customized Color Masterbatches

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- **Technical solutions for**
  - Organoleptic, UL, non-warping, weight reduction, laser marking
- **Special effects for Polymers**
  - Opaque and transparent shades combined with effects like metallic, glitter, pearlescent, phosphorescent, thermochromic ....
- **Functional batches - Color and Additives as 'One-Pack Solution'**
  - Cost effective solutions
  - Correct color tone ensures the necessary additive addition

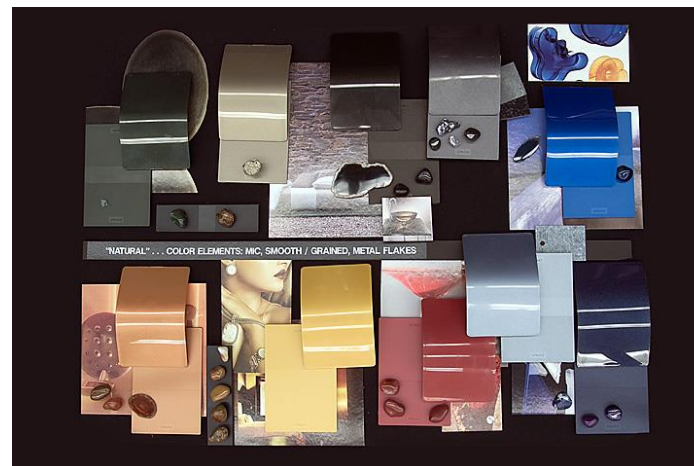
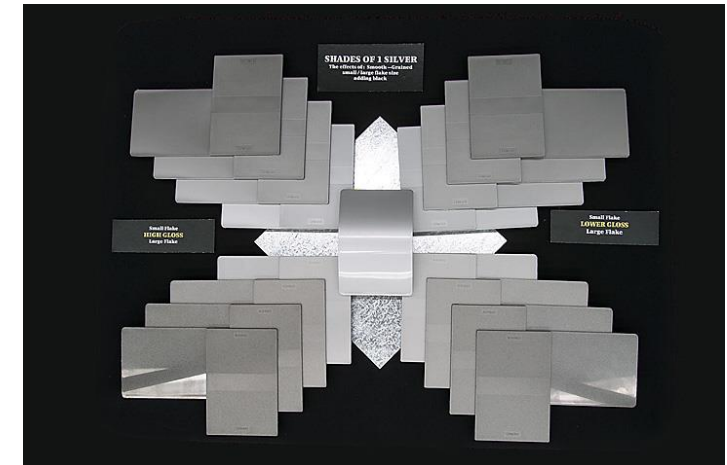
## Special Effects Pigments- A wealth of possibilities



# Special effects - Metallic appearance

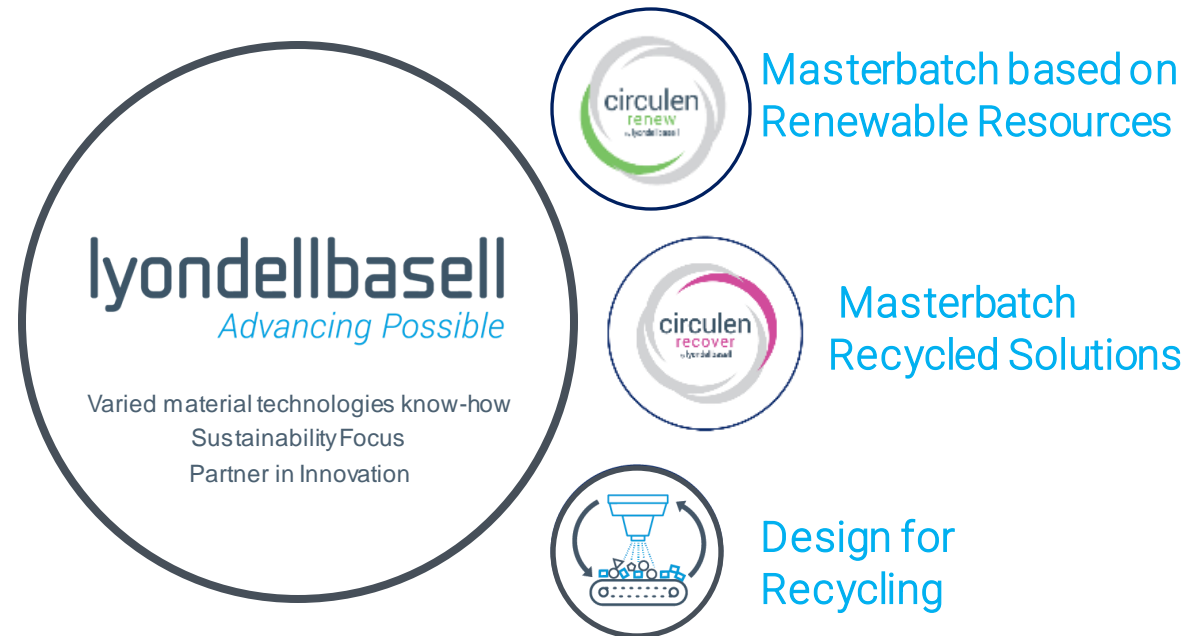
## Value Creation Includes

- Metal and metallic paint replacement
- High gloss accent colors
- Interference / flake type effects



# ADVANCED POLYMERS SOLUTIONS (APS)

*A platform for differentiation.*



## APS product lines:

- Polypropylene Compounds
- Engineered Polymers
- Engineered Composites
- *Catalloy*
- PB-1
- Specialty Powders
- Color Concentrates
- Masterbatches

## Polybatch NIR Black Series

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○ *Polybatch 73622 NIR*

○ *Polybatch 73641 NIR \**

○ *Polybatch PP 73641 NIR*

○ *Polybatch 73644 NIR*

○ *Polybatch PET 73646 NIR*

○ *Polybatch PS 73647 NIR*

(\*) COTREP certified @ 5% use level in PP

## Design for Recycling - NIR detectable Colors

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Optimizing waste separation with a product range that broadly addresses common market needs

- Different polymers
- Thick and thin film molding applications
- Different color strengths
- Food contact compliances:
  - European and FDA
- Trichromatic and Inorganic basis





## Design for Recycling - NIR Black detectable Colors

Characteristics	<i>Polybatch</i> 73641 NIR	<i>Polybatch</i> 73644 NIR	<i>Polybatch</i> PP 73641 NIR	<i>Polybatch</i> 73622 NIR	<i>Polybatch</i> PET 73646 NIR	<i>Polybatch</i> PS 73647 NIR
Polymer Carrier	PE	PE	PP	PE	PET	PS
Carbon Black Free?	✓	✓	✓	✓	✓	✓
Non-magnetic?	✓	✓	✓	✓	✓	✓
Non-warping?	✗	✗	✗	✓	NA	NA
Eu Food Contact?	✓	✓	✓	✓	✓	✓
FDA Food Contact?	✓	✓	✓	✗	✓	✓
Addition Rate	2 - 10%	1 - 10%	2 – 10%	2 - 10%	2 – 5%	2 – 5%
Features	Standard version	High strength version for use with PCR.	PP carrier version	Neutral color	PET carrier version	PS carrier version
Applications	-Thick w all molding -Opaque articles.	-Thick w all molding -Opaque articles. -Use with PCR	-Thick w all molding -Opaque articles. -Use if PP carrier is needed	-Thick & thin w all molding -Opaque & semi-transparent articles.	-Thick w all molding -Opaque articles.	-Thick w all molding -Opaque articles.

## Recycled Solutions

- Colors and combination of masterbatches for all available PCR materials

### Color Masterbatch

used in *CirculenRecover*  
Ivory PCR



## Recycled Solutions

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- Colors and combination of masterbatches for all available PCR materials

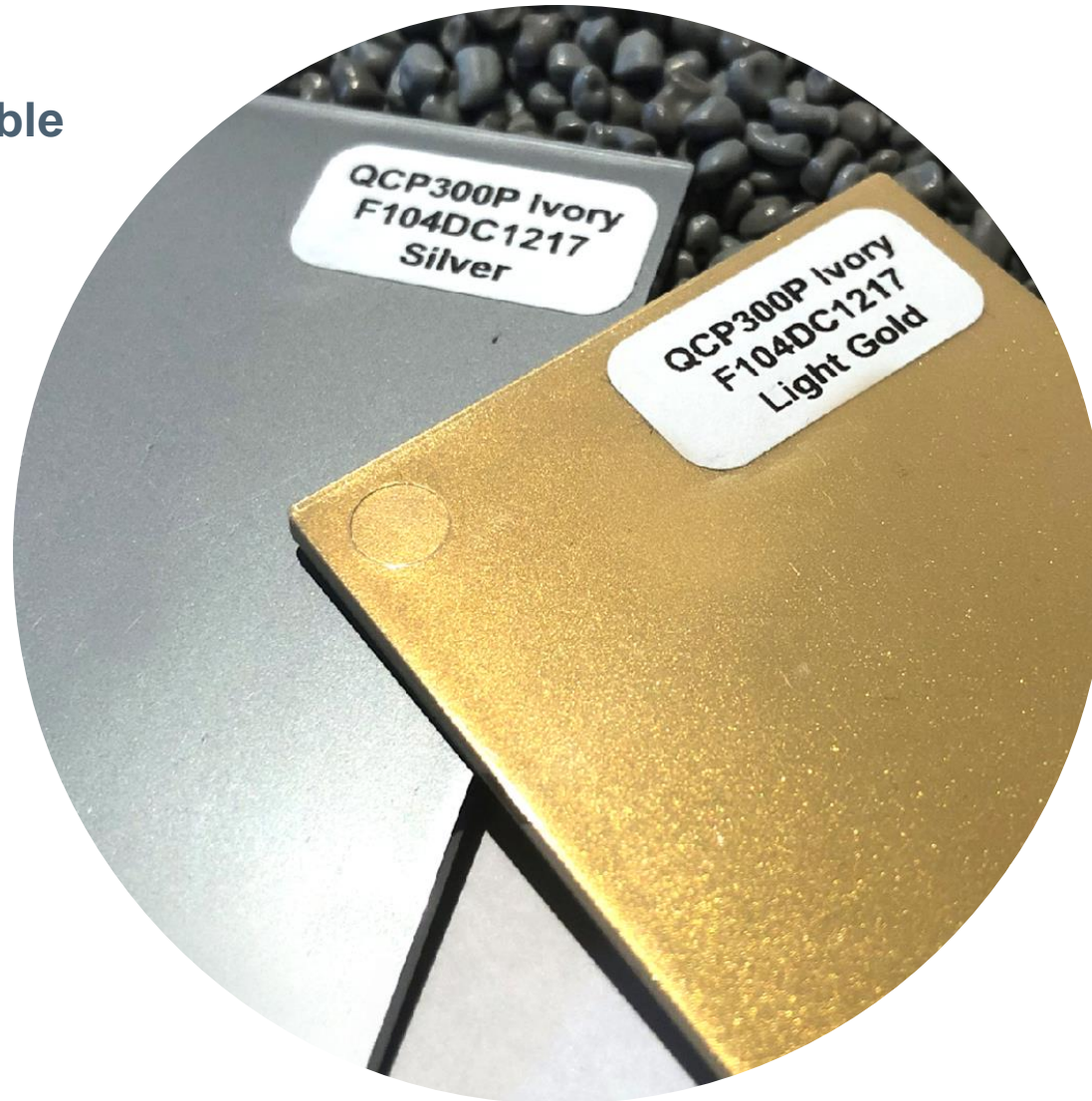
**Color Masterbatch**  
used in *CirculenRecover*  
Grey and Ivory PCR



## Recycled Solutions and Special Effects

- Colors and combination of masterbatches for all available PCR materials

**Metallic Color Masterbatch**  
used in *CirculenRecover* Ivory  
PCR



## Why choose for LYB Color Concentrates?

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We offer:



Thank you

## DISCLAIMER AND TRADEMARKS

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