

EFFECT PIGMENTS FOR PLASTICS

Subline / Presenter, Place, Date

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- 02 PIGMENTATION OF THERMOPLASTICS
- 03 BLOW MOLDING
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- 05 THERMOFORMING
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- 07 CAST RESINS
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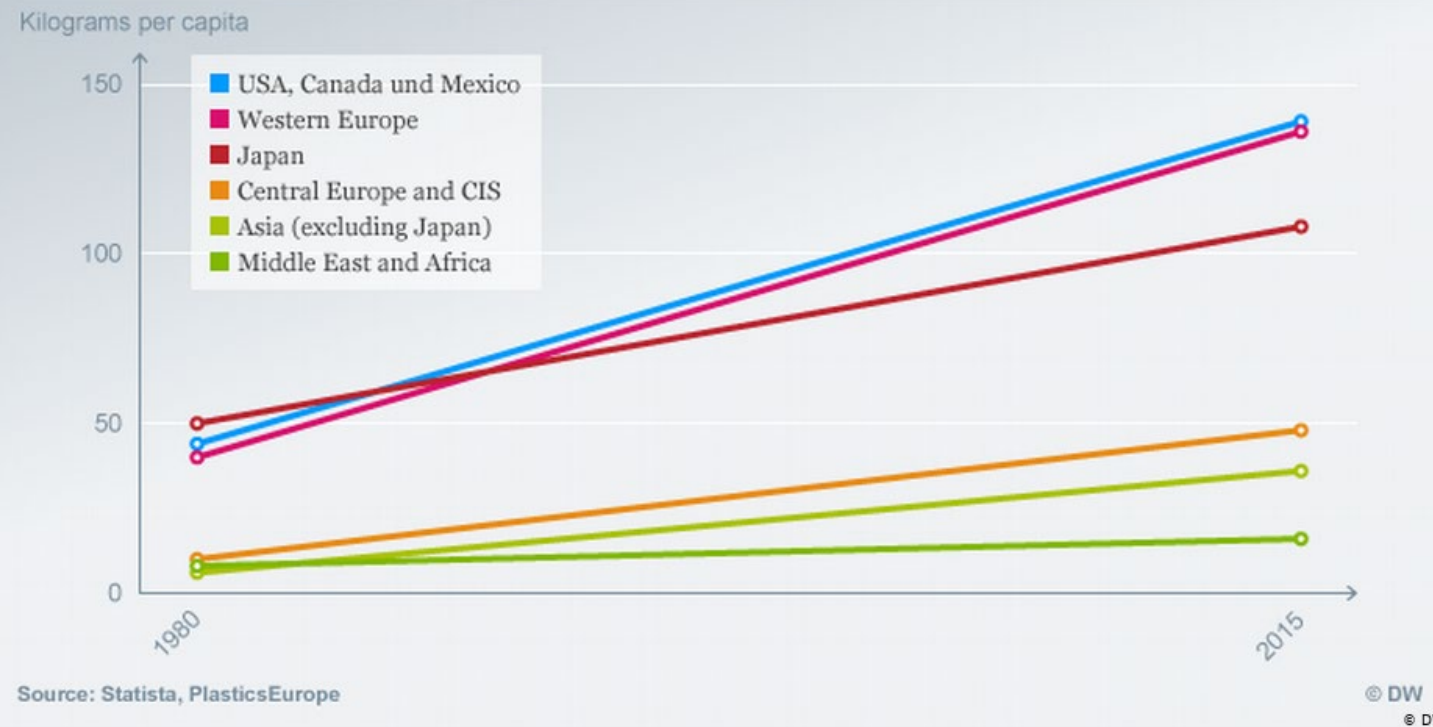
MARKET AND APPLICATION

Plastics

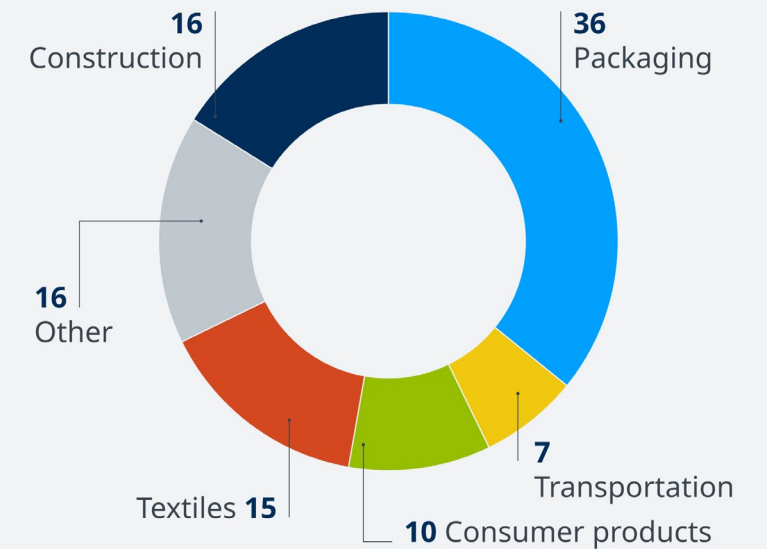


Plastic use

Plastic use: Industrial nations top the charts

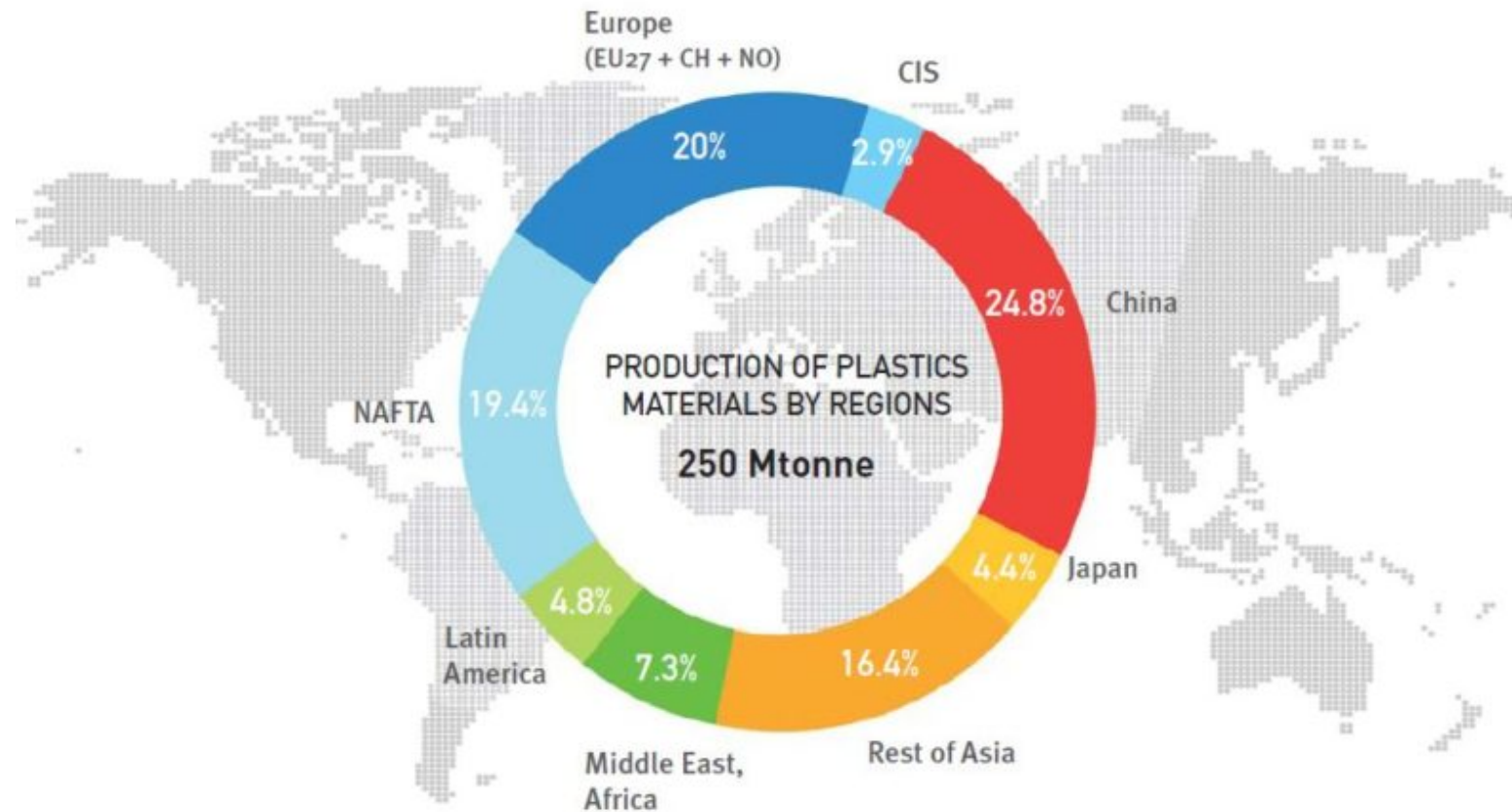


Estimated consumption of plastic by end-use sector



PLASTICS MARKET

Regional Markets



Source: <https://plasticknowledge.com>

EFFECT PIGMENTS

- Can be used for food packaging (FDA) and even toys (EN71).
- They present no problems for plastic recycling
- The more transparent the polymer, the better the effect
- The excellent temperature resistance up to well over 800°C makes them highly suitable for thermoplastics but they can also be applied in duroplastics.
- The pigments are physiologically harmless and do not migrate; therefore, they can be used in food packaging and also meet the European norm EN 71/part 3 for children's toys.

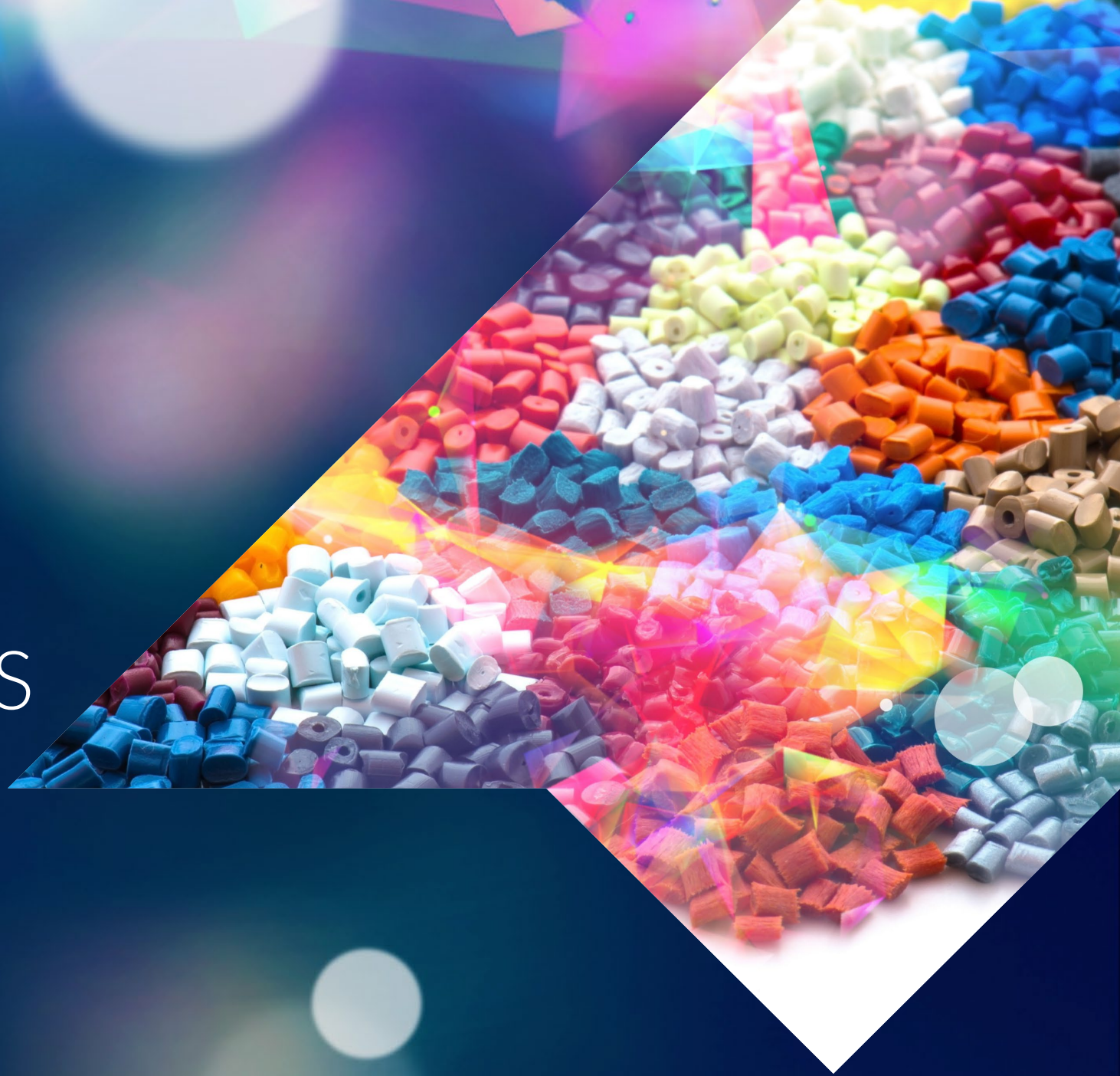
Kuncai Effect Pigments
are basically
suited for the use
in all kind of plastics

Processes

- Blow molding
- Stretch blow molding
- Tube extrusion
- Sheet extrusion
- Injection molding
- Cast resins



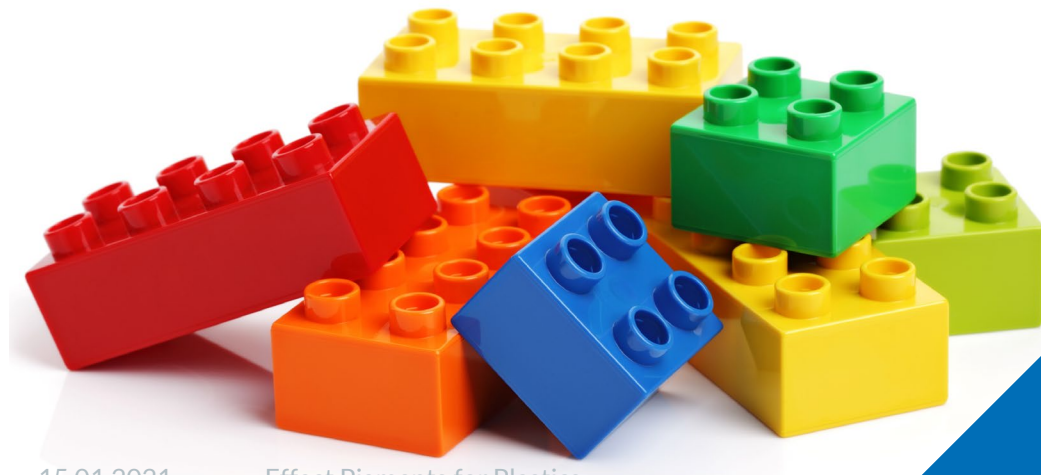
PIGMENTATION OF THERMOPLASTICS



Definition

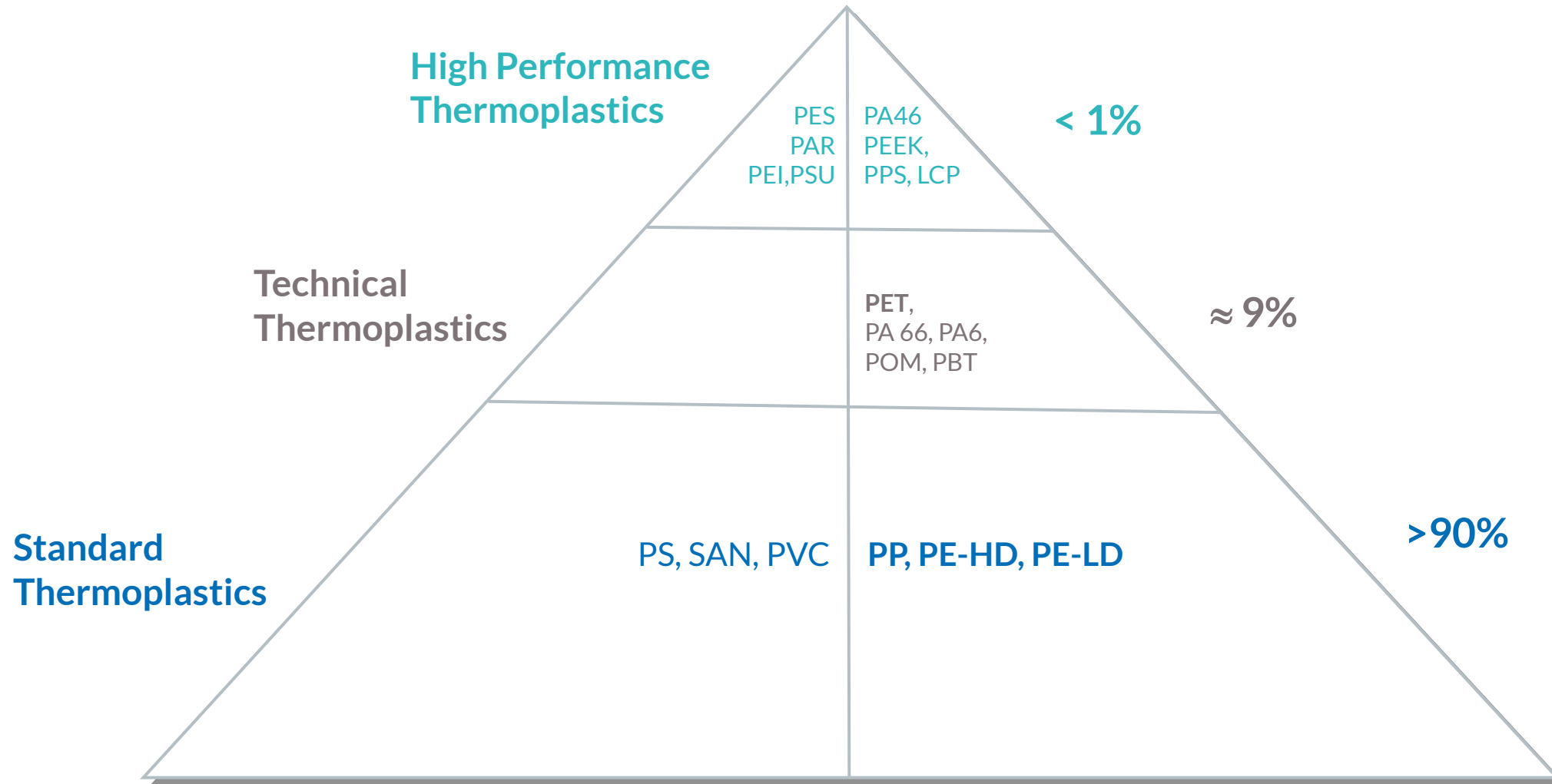
Thermoplastics melt to a liquid when heated and freeze to a brittle, glassy state when cooled sufficiently.

Most thermoplastics are high molecular weight polymers. Thermoplastic polymers can be remelted and remolded.

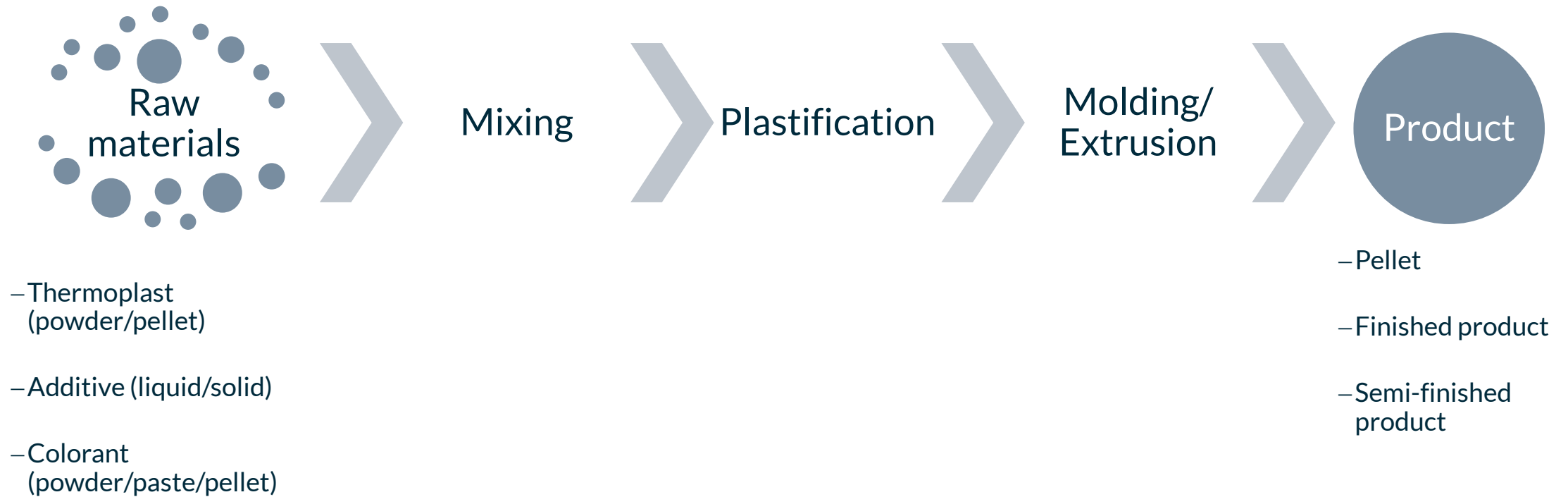


THERMOPLASTICS

Classes of Thermoplastics

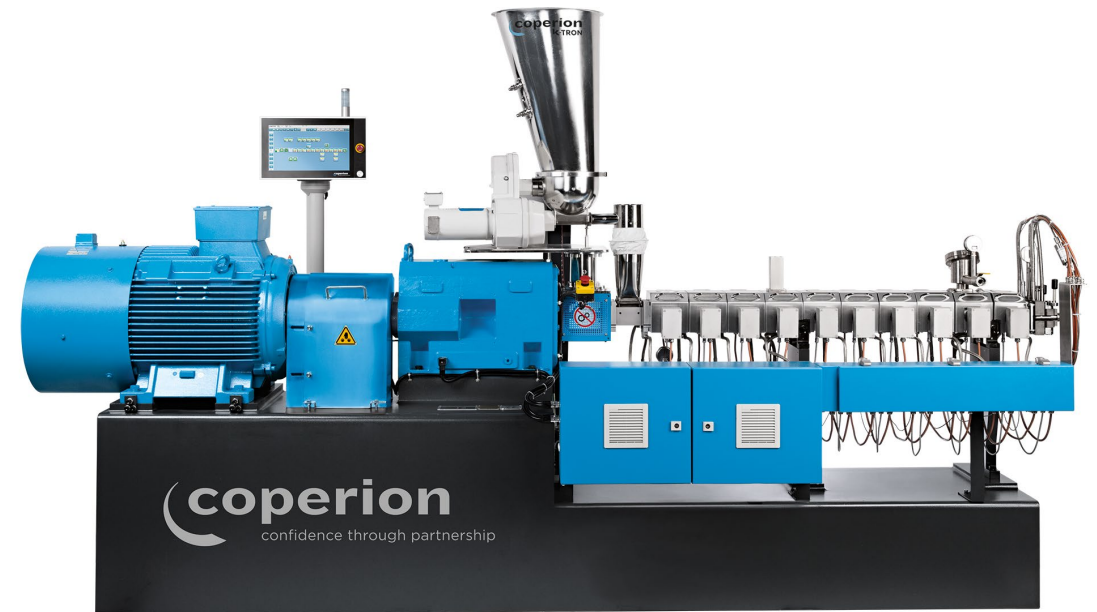
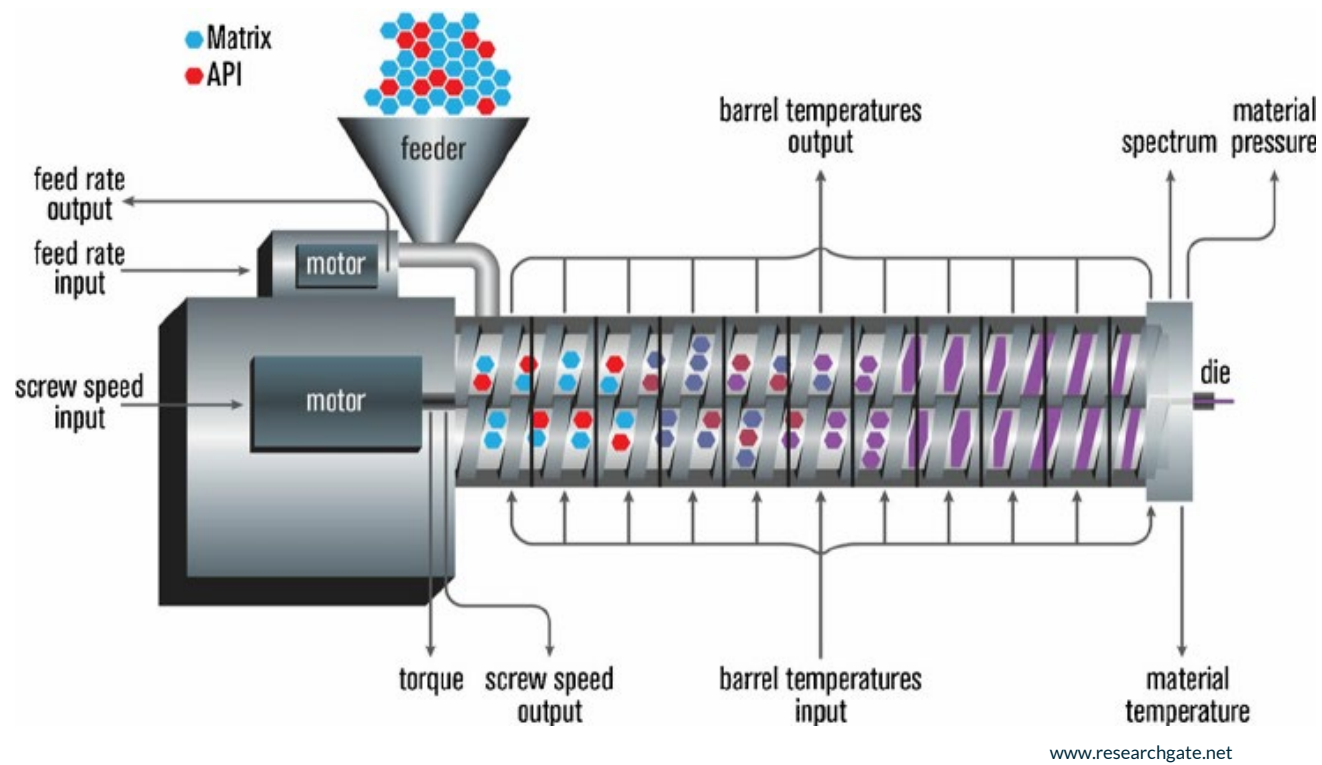


Processing



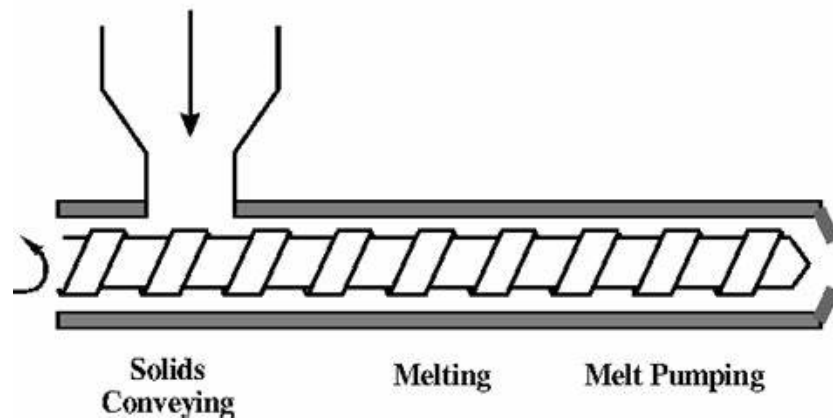
PLASTIFICATION

Extruder Operation

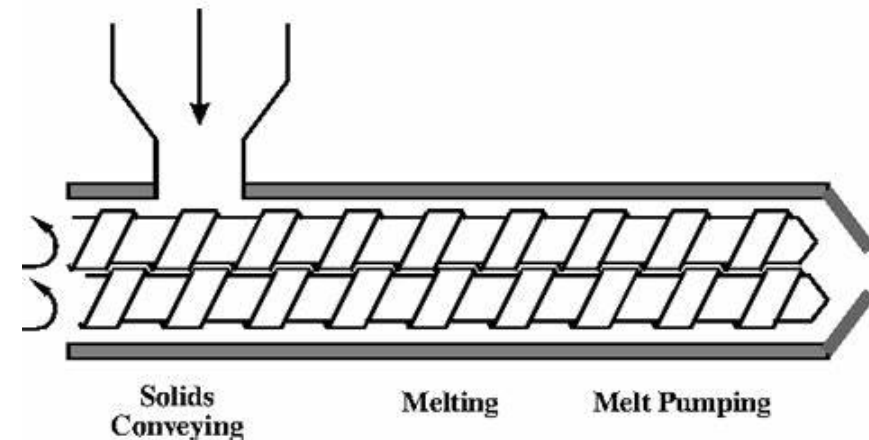


Single Screw vs. Double Screw

- Single screw extruder is open to funnel and gate
- The rotation of the screw changes the flow of the melt
- Drag flow: responsible for conveying
- Pressure flow: responsible for mixing movement
- Leakage flow: responsible for lengthwise mixing



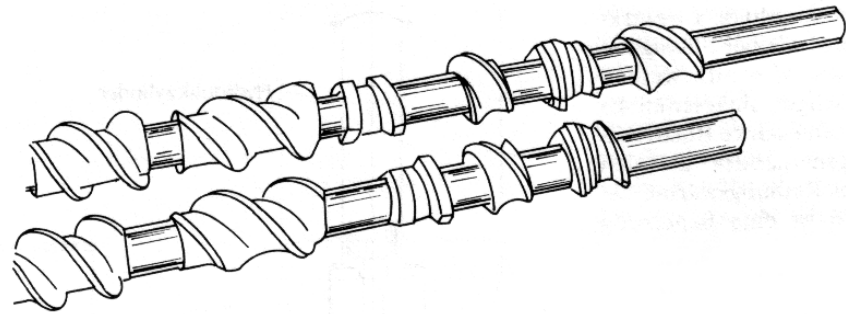
- The double screws and the cylinder form closed chambers
- Melting and mixing takes place mainly inside of these chambers



www.starplas.com

PLASTIFICATION

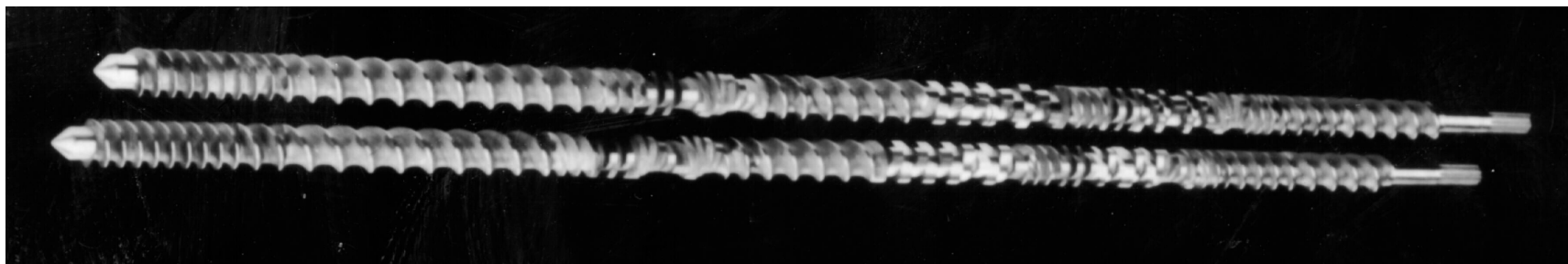
Double Screw Extruder



Modular screw design
with kneading- and conveying
elements



Screw elements



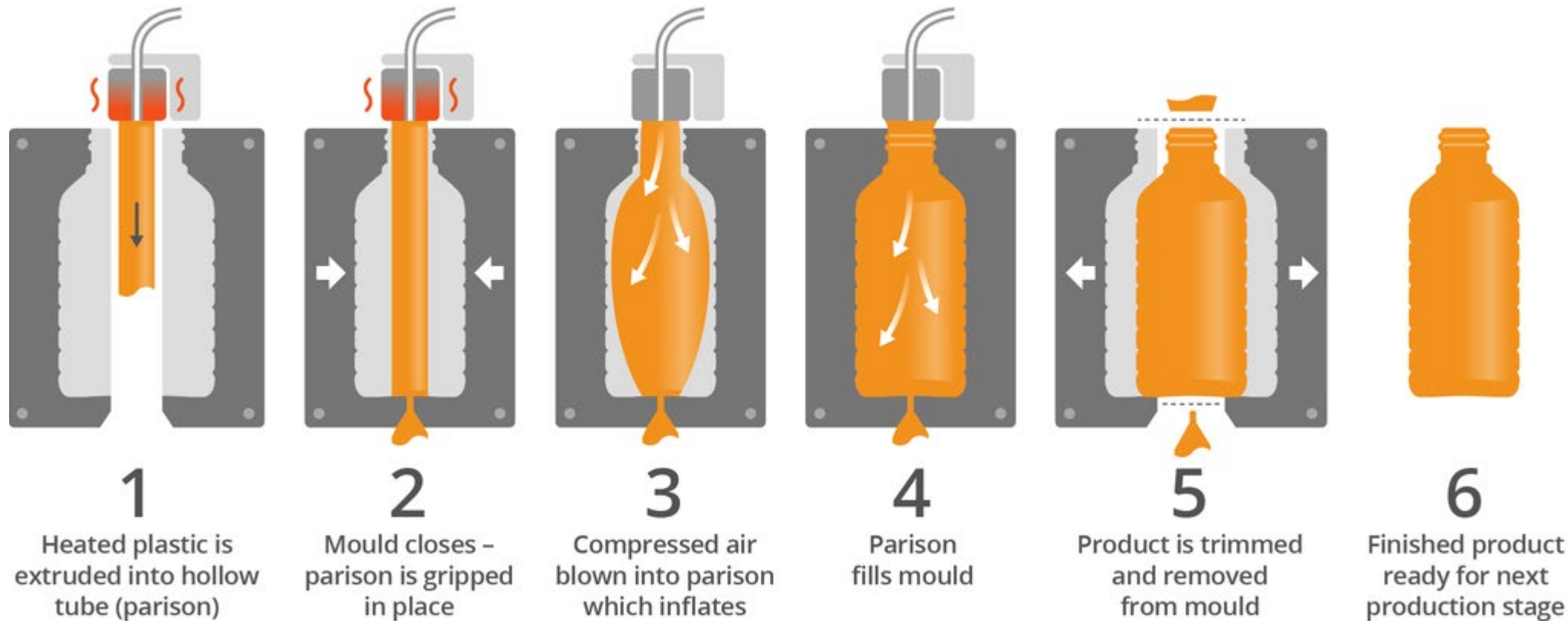
Temperature Profile Masterbatch Production

Heating zone	Polymer					
	PP Metocene	PP Moplen	PC Makrolon 3103	PET Melinar Laser +	ABS Polyman M/MI	ABS Terluran GP 22
	[°C]	[°C]	[°C]	[°C]	[°C]	[°C]
1	200	180	260	270	220	240
2	220	200	260	280	230	245
3	220	200	260	280	230	245
4	220	200	280	280	230	245
5	210	200	280	280	230	250
6	210	200	280	280	230	250
7	210	200	280	270	230	250
8	200	200	280	265	230	255
9	200	200	275	260	225	255
10	200	190	270	260	220	255

BLOW MOLDING



EXTRUSION BLOW MOLDING



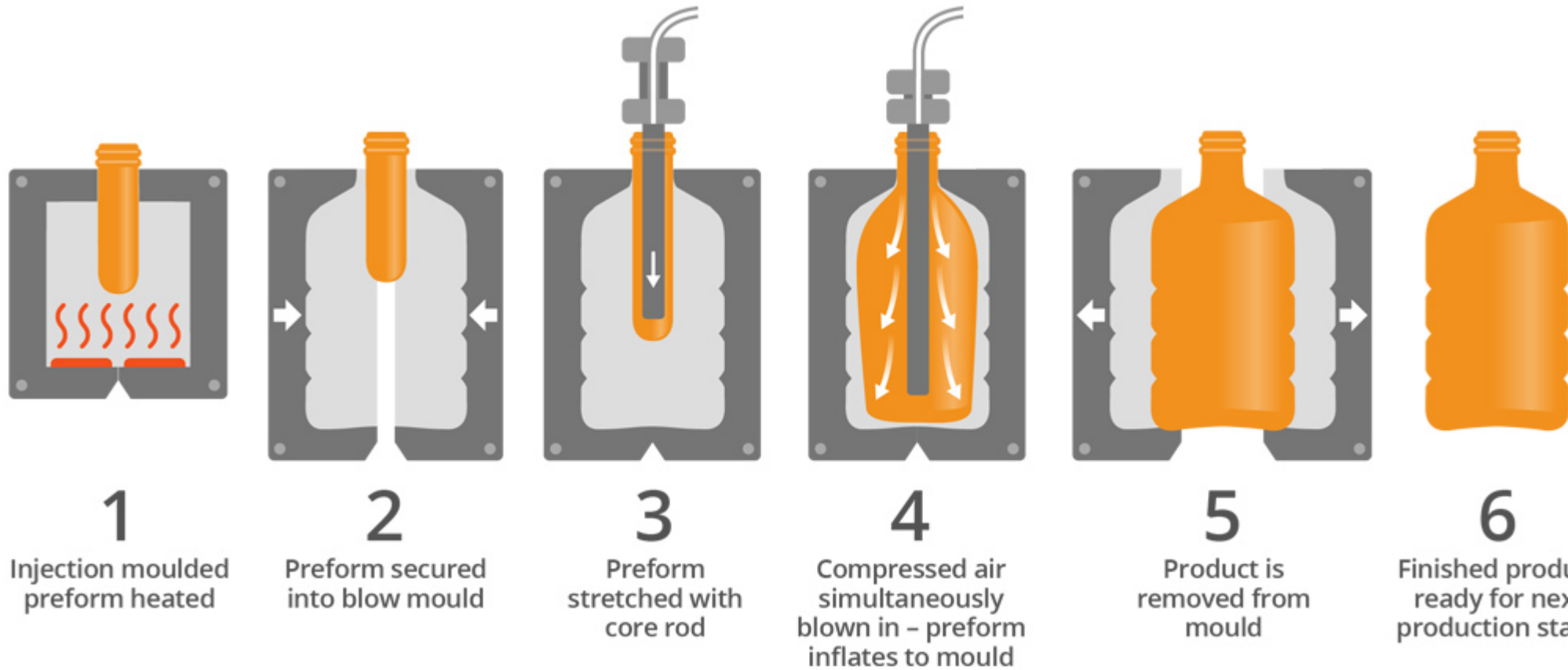
Extrusion blow molding is a process for manufacturing hollow bodies. These can be round, angular, or oval and also have handles, as on the familiar detergent or drinking bottles. In contrast to injection stretch blow molding, extrusion blow molding is a continuous, one-level process.

Polyolefins such as LDPE, HDPE, and PP are the most typical materials used.

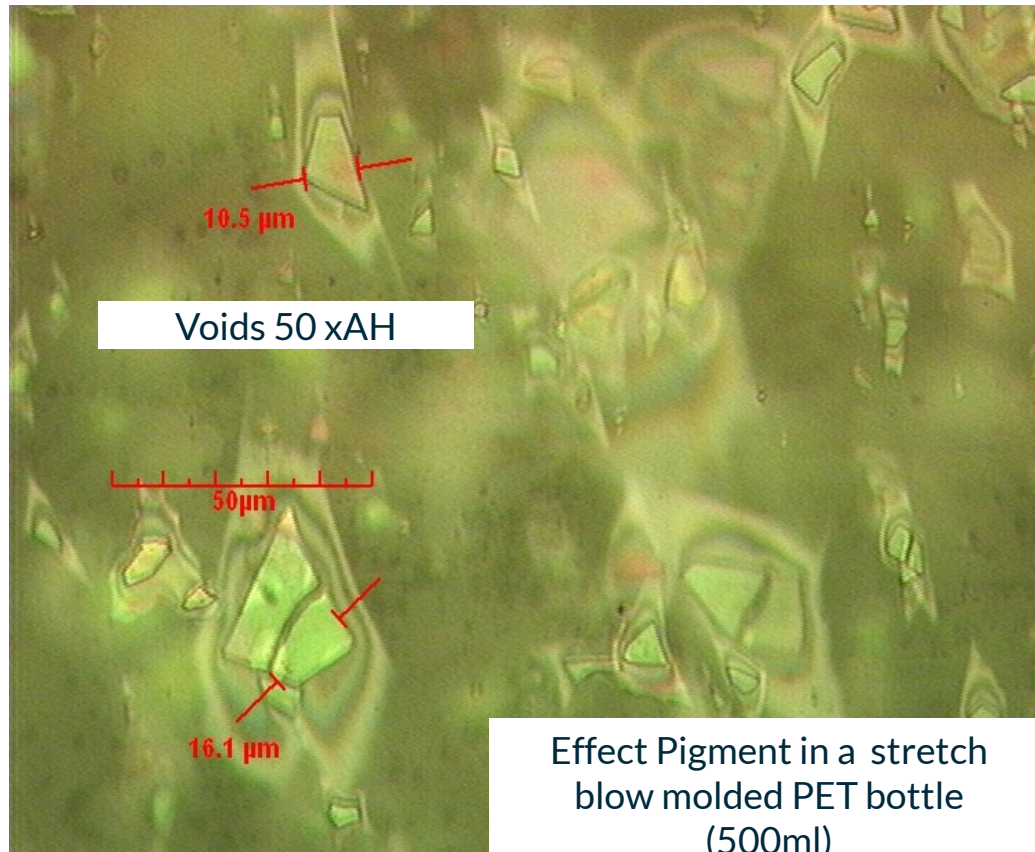
- ✓ Effect pigments are well suited to the extrusion blow molding process, since the extrusion process guarantees platelet-shaped effect pigments are aligned with the surface and show their full optical effect.
- ✓ This is an efficient option for combining high coverage with striking effects.
- ✓ Strong pearl luster and other effects can be achieved with a thin outer layer, while the desired opacity is created by the inner layer.

STRETCH BLOW MOLDING

PET Bottles



Voids



- Due to the gentle heating during the blow molding process, the thermoplastic's elasticity is limited.
 - Effect pigments are not malleable.
 - The blow mold stretching creates voids between the polymer and the rigid effect pigments.
-
- ✓ The larger the effect pigments and the higher the stretching ratio, the more obvious the voids are.
 - ✓ Effect pigments can be used at stretching ratios of up to 3:1.
 - ✓ As the plastics is still in a semi-viscous state 1-level or 1.5-level processes are more suitable.
 - ✓ Void effects are also used to achieve the "frost effect" in PET bottles.

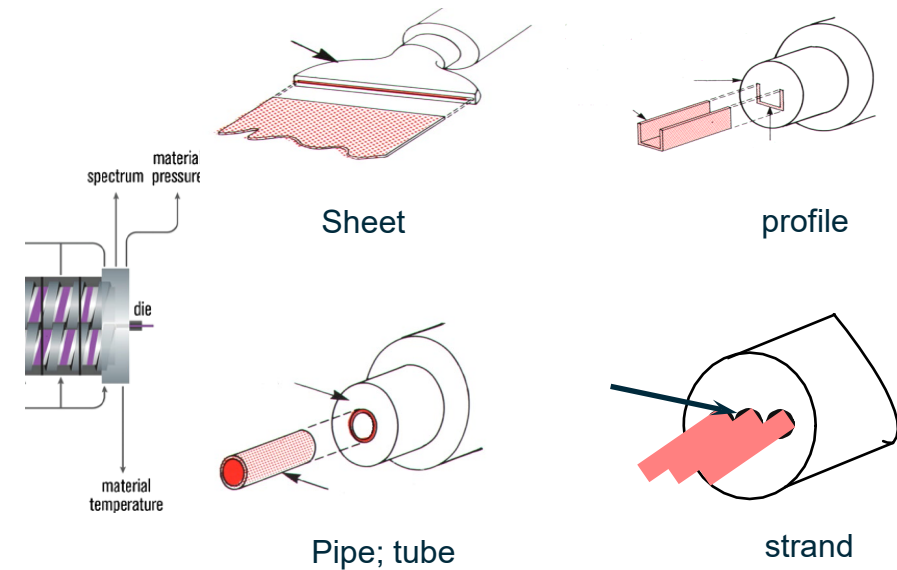
The background features a dynamic composition of thick, glossy, multi-colored lines (red, yellow, purple, white) that curve and flow across the frame. On the right side, there are complex, multi-faceted geometric shapes in various colors (blue, green, pink, yellow) that resemble crystalline or low-poly structures. The overall aesthetic is modern and high-tech.

EXTRUSION & CO-EXTRUSION

Extrusion is a very important step in the manufacture of blow molded objects, films, sheets, plates, tubes and profiles. It has the function to melt and homogenize the plastic and also to build up pressure and eject the material into the molding units.

Films, foils, and plates are extruded through flat nozzles. Nozzles with larger openings are used for solid rods, tubes, or flat profiles.

Irregular shapes such as angled profiles, for example L or T shapes, and complex shapes like window profiles can also be manufactured using an extrusion process.



The flow in the extruder head and in the gap gives orientation to the pigment platelets.

Co-Extrusion

- ✓ The use of effect pigments in the surface layer ensures a good effect strength and a cost saving aspect due to the perfect orientation of the effect pigments on the visible surface.
- ✓ Due to the much thinner co-extrusion layer, a higher concentration of effect pigments must be used than in regular extrusion.
- ✓ A lower concentration of pigments is needed when the entire layer mass is colored.
- ✓ The inner layer in co-extrusion usually uses high coverage. Normally no effect pigments are used here.

Masterbatches or compounds are used to color the molten mass with effect pigments.

Co-extrusion is used to combine different materials or the same materials with different colors or effects.

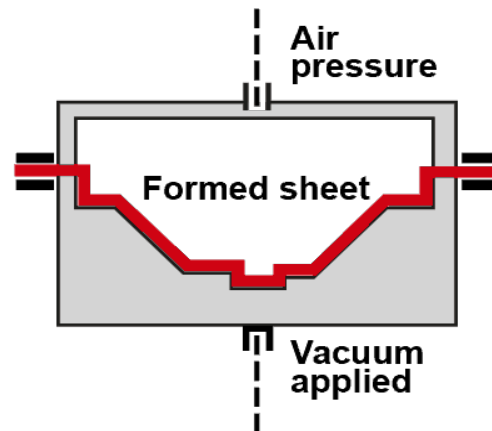
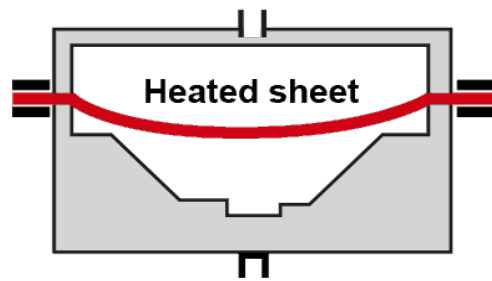
The two materials are combined into one flow in the co-extrusion die.



THERMO FORMING

OF EXTRUDED SHEETS



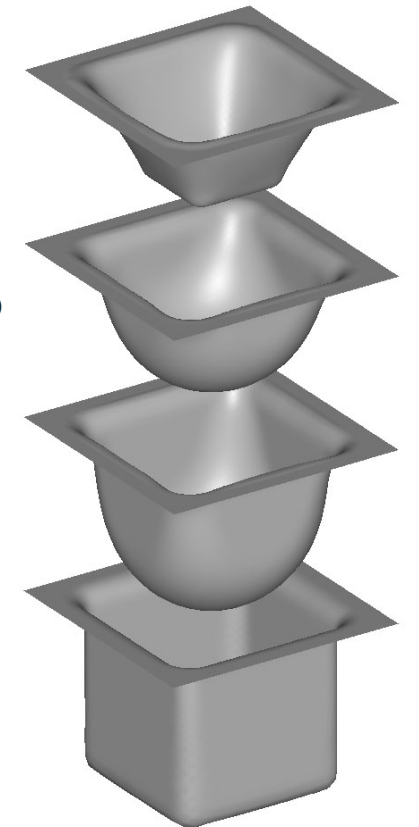


www.canonplastec.com

A semi-finished product is produced, heated just below its melt temperature and changed to the desired configuration

→ An extruded or co-extruded sheet is formed into a three-dimensional form

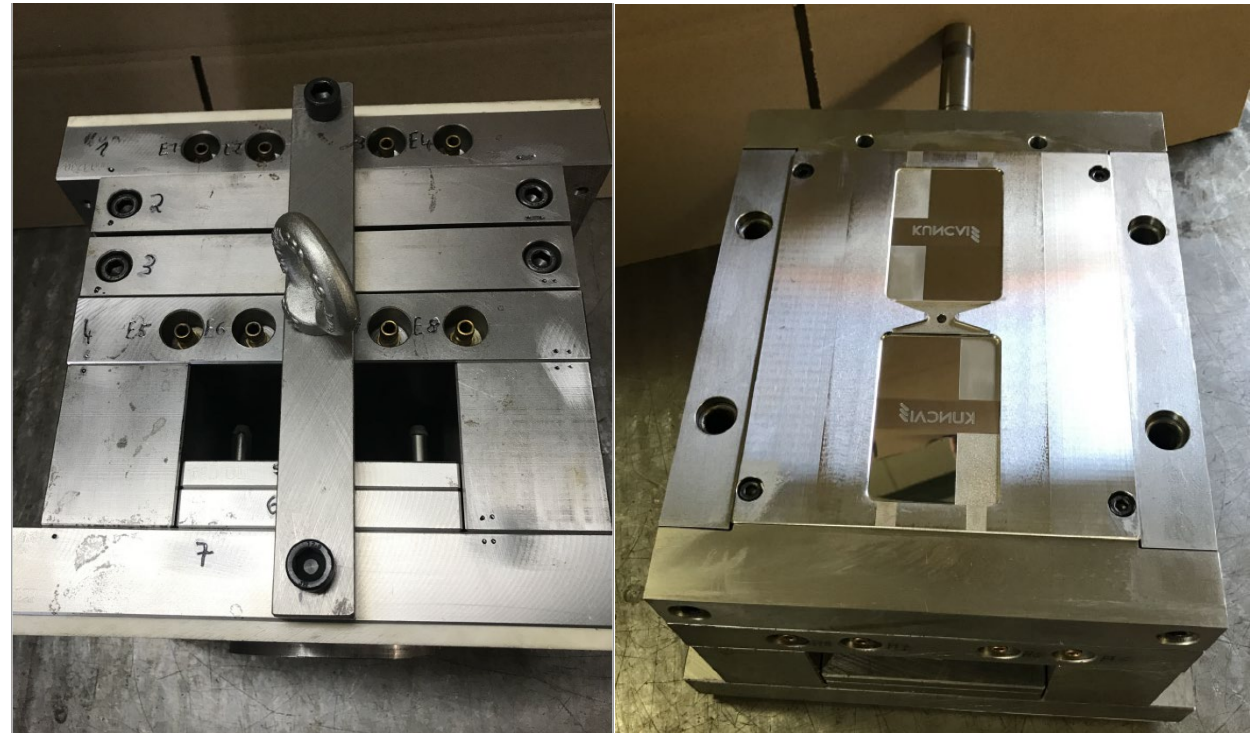
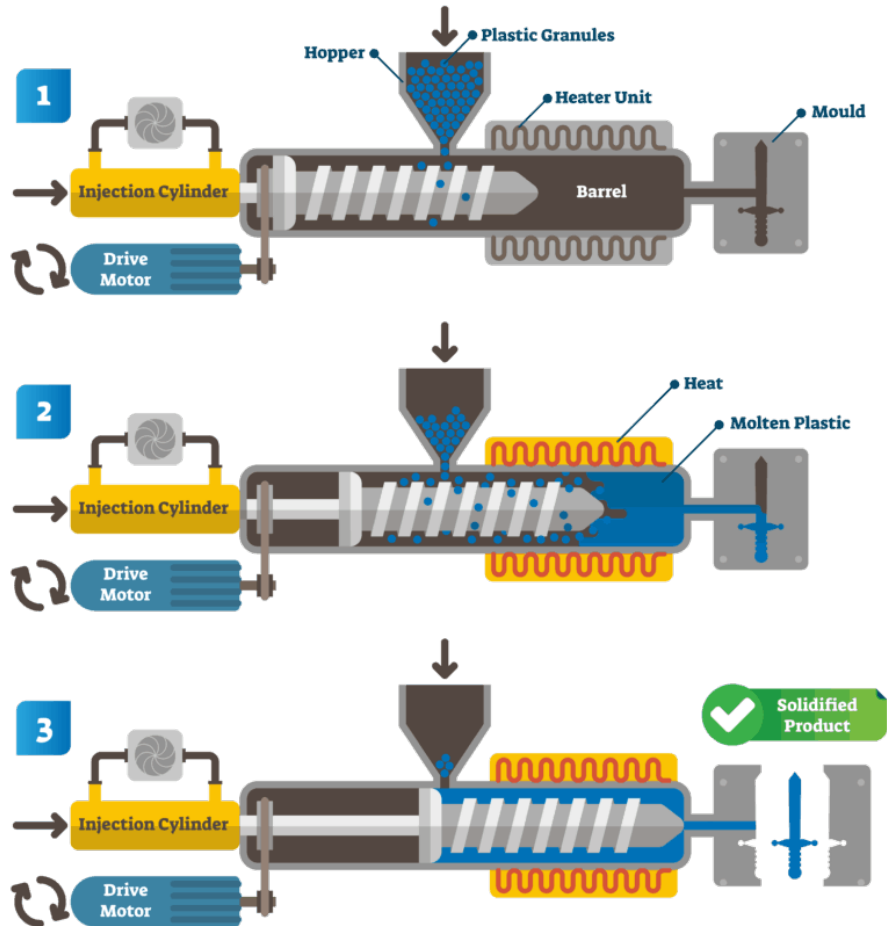
1. Air blowing,
2. Deep drawing (vacuum)
3. Die-pressing (matched mold forming)



INJECTION MOLDING

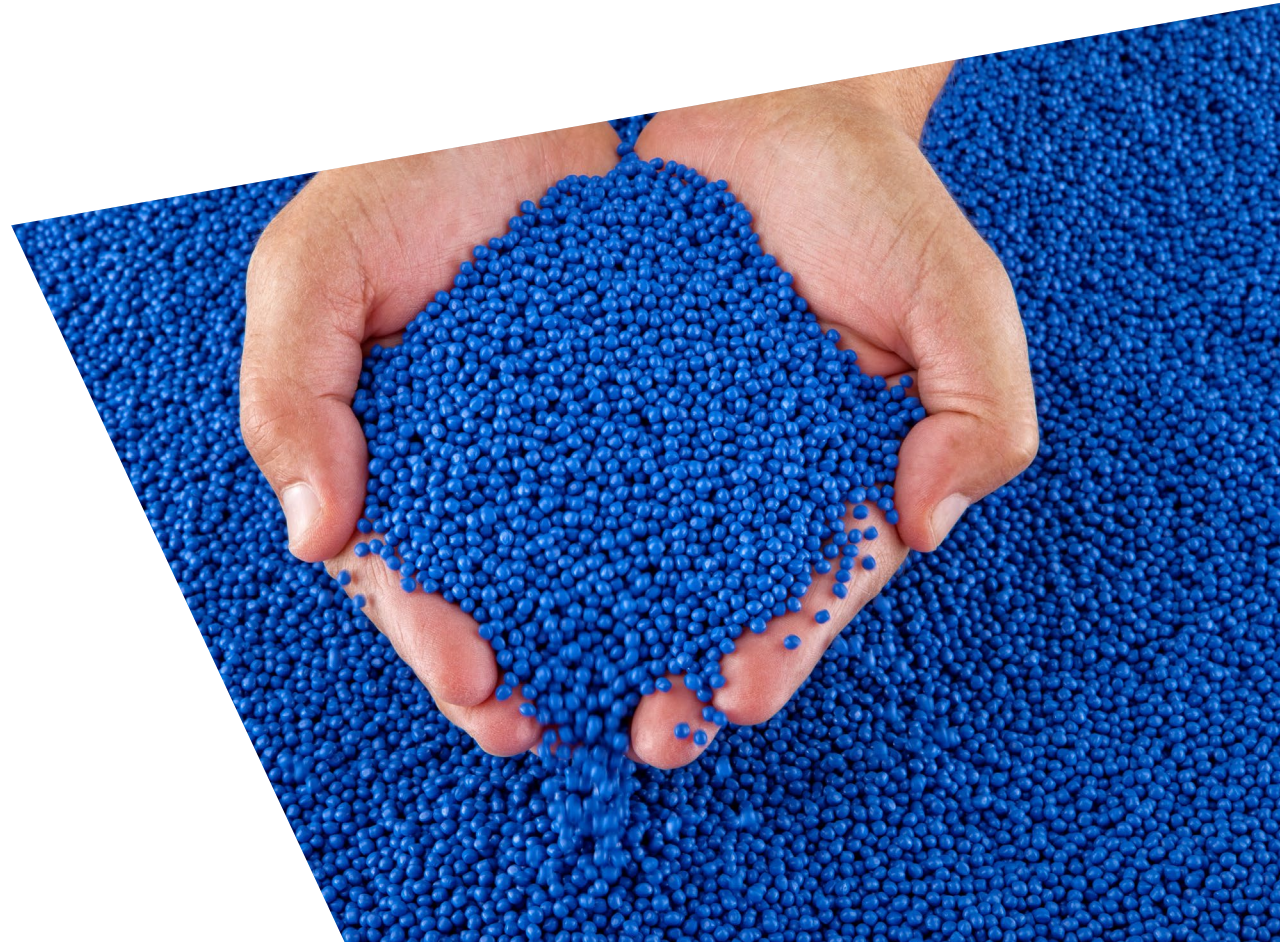


INJECTION MOLDING



Injection mold

- ✓ For best pigmentation results in-use granulated color concentrates (masterbatch).
- ✓ A typical pearl luster masterbatch consists of 20-50% effect pigment in a medium comparable to the material of the final application.
- ✓ Dyes or color pigments can be added to adjust the final color.
- ✓ The screw geometry should be adjusted so pigments are fully dispersed but not too many pigment platelets are destroyed in the process.



Plastic Granules

- ✓ Fixing the pigment on the plastic granules with the aid of 0.2% to 0.5% liquid coupling agents like softeners or highly refined mineral oils is recommended to avoid separation.
- ✓ Small particle-sized plastic granules (<3mm) promote a good pigment distribution.
- ✓ Suitable for injection molding compounds with relatively low viscosity up to a pigment content of about 2%.



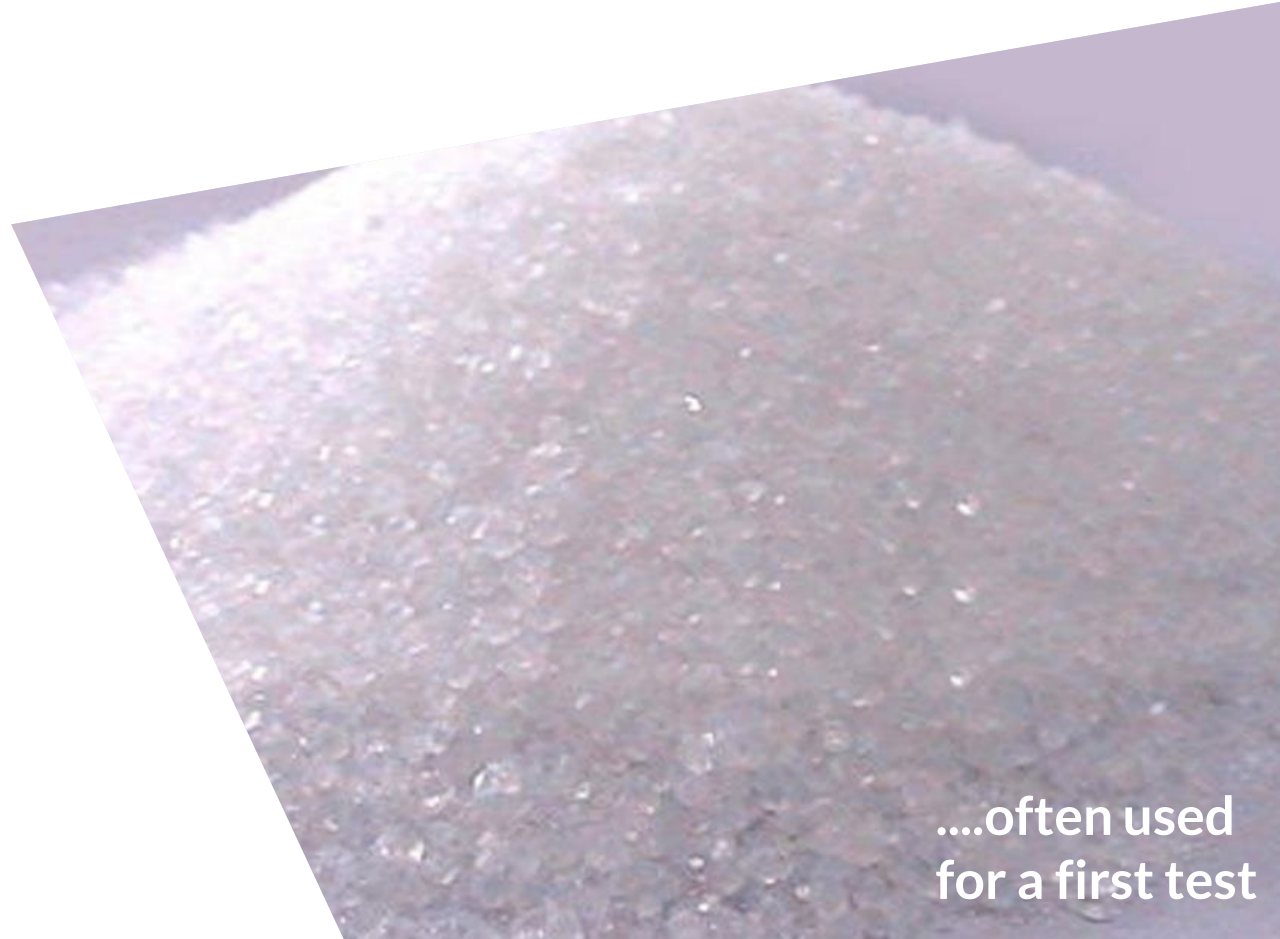
**...often used
for a first test**

DIRECT PIGMENTATION

Pigment Powder

PVC or Masterbatch production

- ✓ Mixing with tumble or high-speed mixer.
- ✓ In compounding PVC with high-speed mixers (dry blend), the mixing time should be kept as short as possible to avoid pigment damage.
- ✓ This can be managed by adding the pigments shortly before the end of the mixing time.

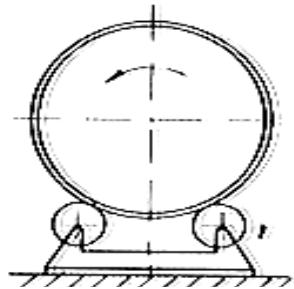


....often used
for a first test

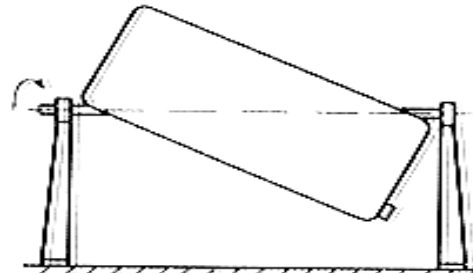
DIRECT PIGMENTATION

Mixing

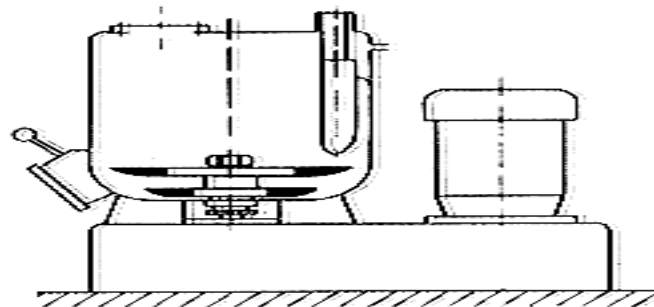
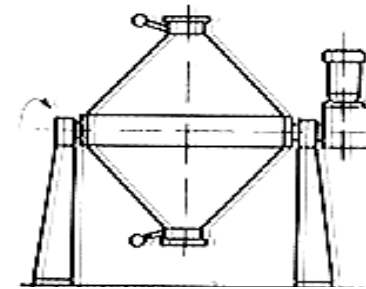
Barrel mixer



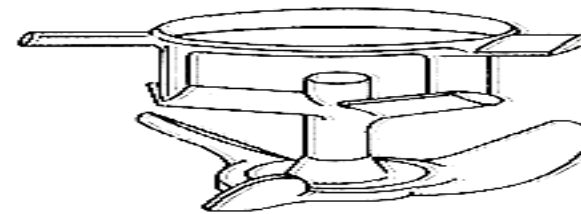
Tumble mixer



Double cone mixer



Fluid mixer



Mixing tool

DIRECT PIGMENTATION

Liquid Color Concentrates

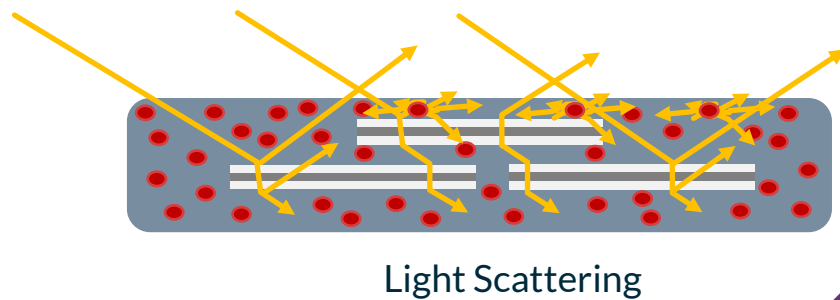
In use for injection molding and PET coloring:

- ✓ Settling of the pigment platelets must be taken into account.
- ✓ The formation of a solid sediment bed can be avoided by using thixotropic agents or pigment flocculation.
- ✓ Low pigment damage.

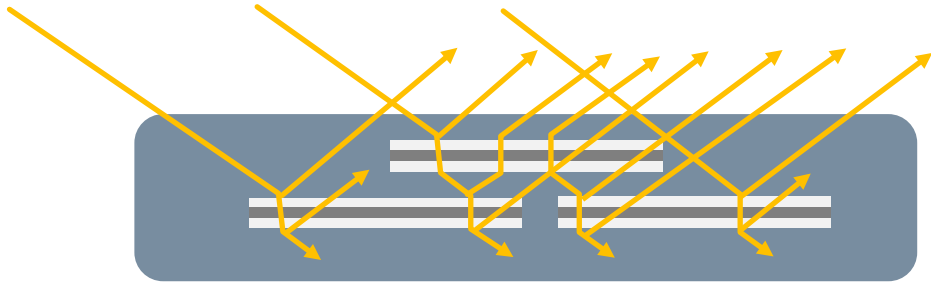


The more opaque the plastic, the more the:

- Brilliance decreases
- Effect strength decreases
- Tinting strength decreases
- Color clarity decreases

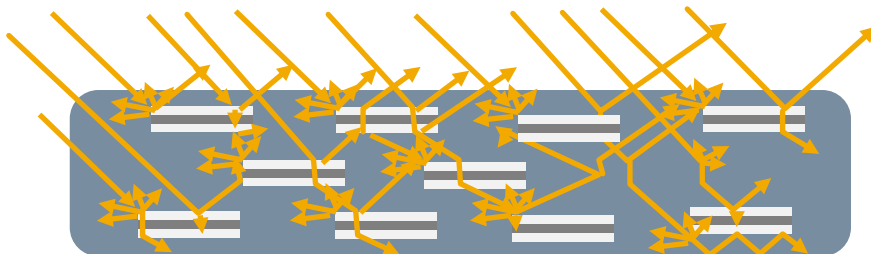


Impact on Hiding Power



Large Particle Size Distribution

- Strong reflection of incoming light
- Higher transparency
- Low influence on background color
- Stronger sparkle



Small Particle Size Distribution

- Higher light scattering
- Increased hiding power
- High influence on background color
- Silky effect

Impact on Hiding Power

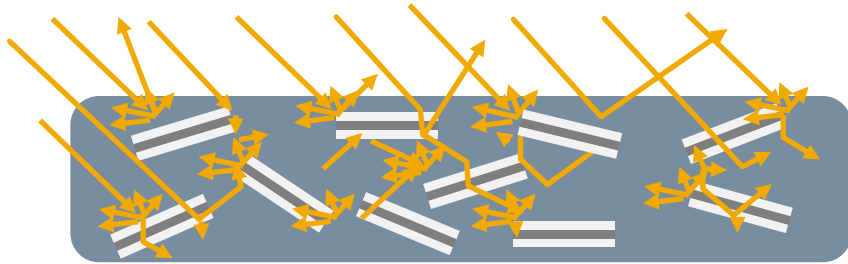
Small Particle Size Distribution

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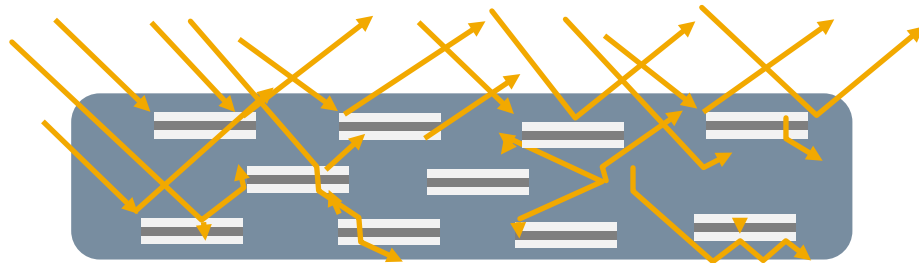


Large Particle Size Distribution

- Strong reflection of incoming light
- Higher transparency
- Low influence on background color
- Stronger sparkle



Random orientation → NO EFFECT

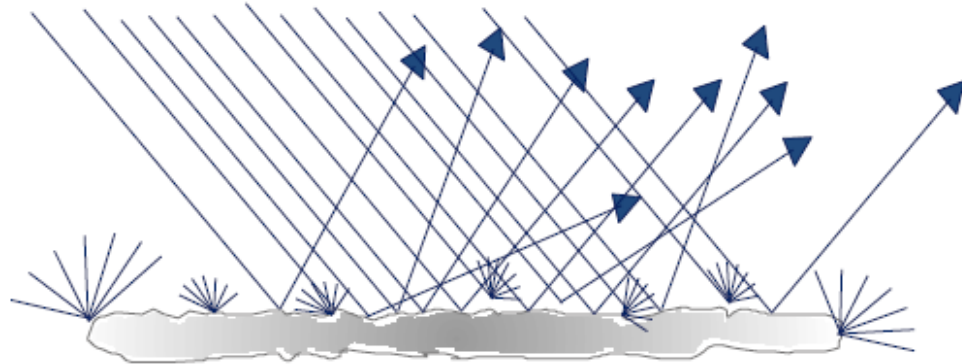


Parallel orientation → EFFECT

00 PIGMENT ORIENTATION

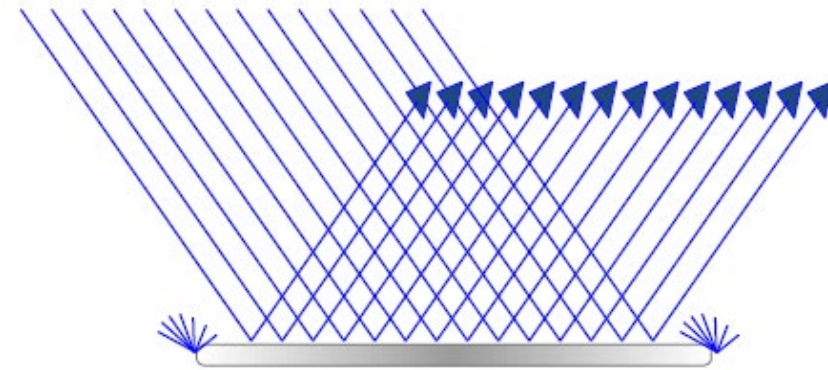
Impact of Surface Structure on Effect

Rough Surface



- Scattered reflection
- Lower flop
- Lower brightness
- Better hiding

Smooth Surface

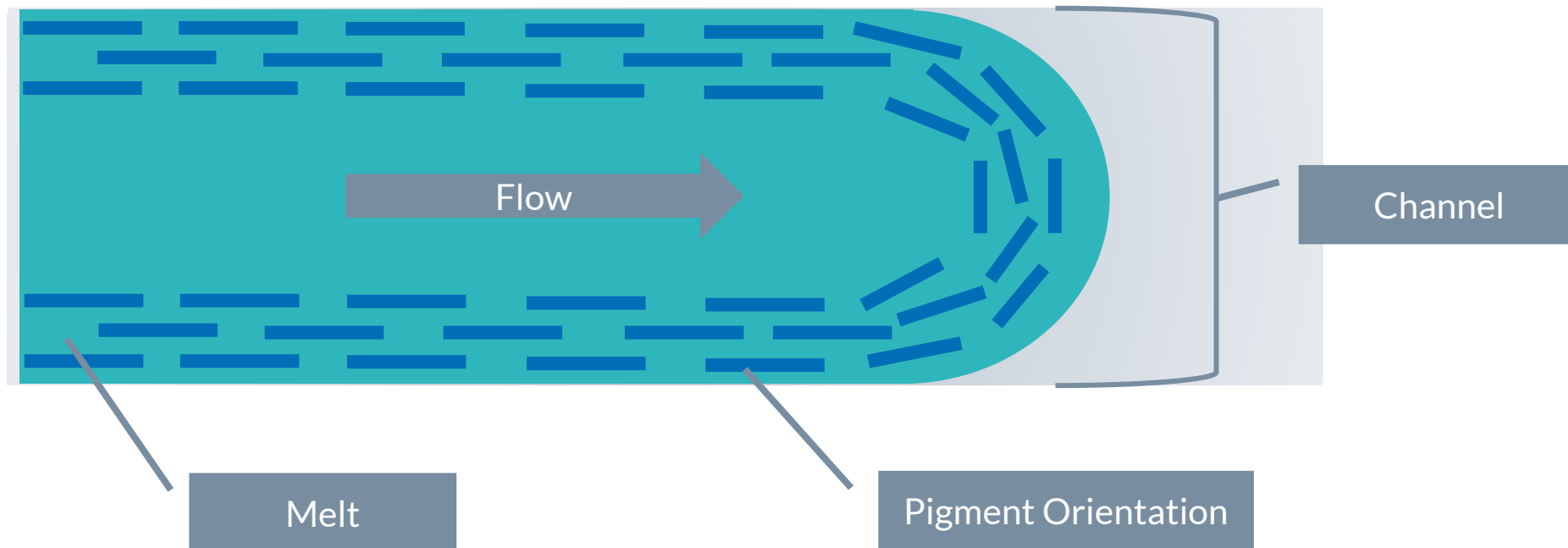


- Uniform reflection
- Greater flop
- Higher brightness
- Greater transparency

PIGMENT ORIENTATION

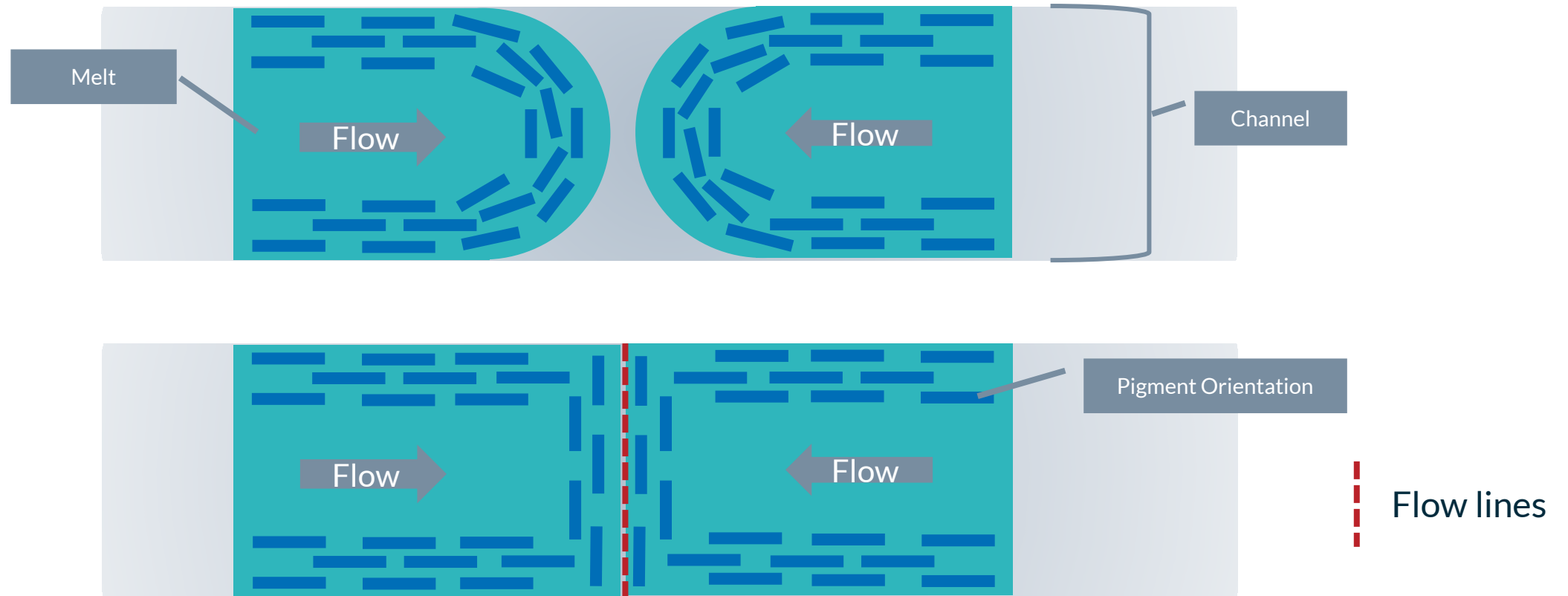
Flow Lines

- Orientation is given to the pigment platelets by the flow of the matrix.



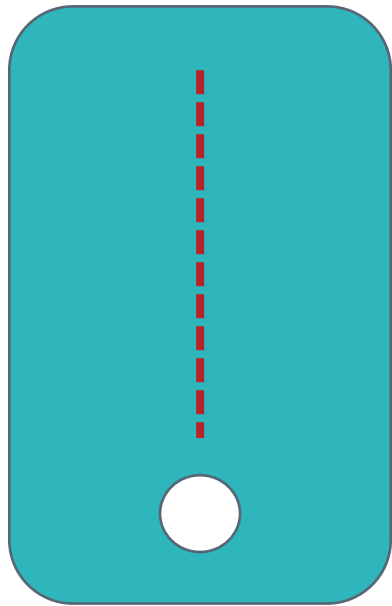
PIGMENT ORIENTATION

Building of weld lines

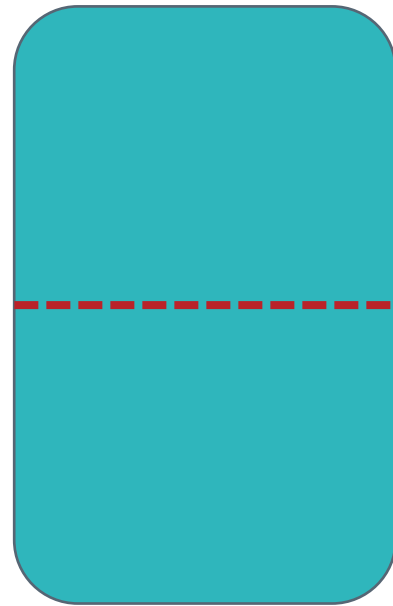


PIGMENT ORIENTATION

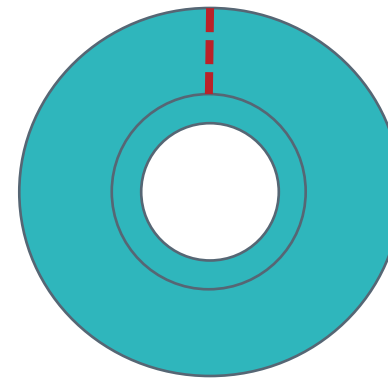
Mold Design



Meltflow around a hole



Multiple sprues



Different wall thickness

Flow lines

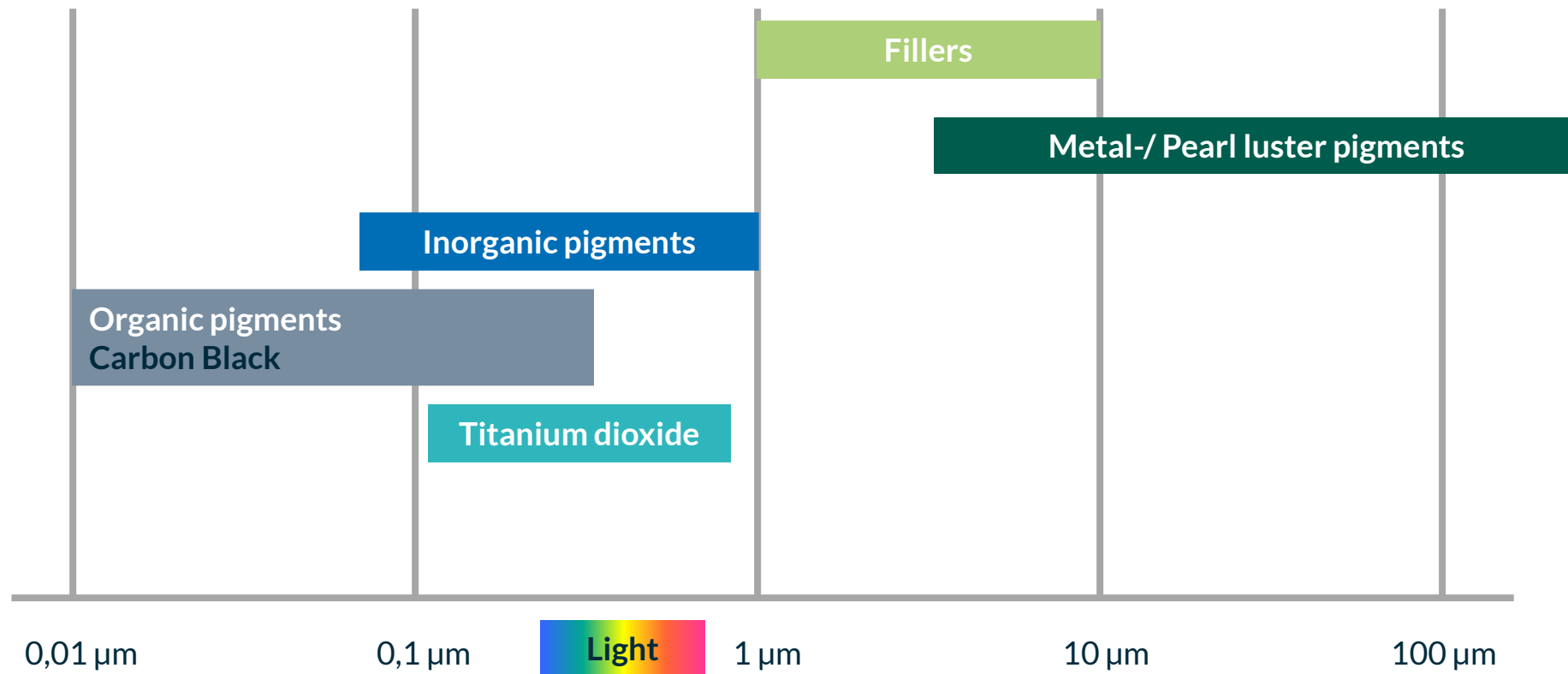


Avoiding Flow Lines

- ✓ Well-engineered tool construction – effect pigments can orient perfectly to avoid flow lines or welding effects.
- ✓ Optimizing the position of the injection gate.
- ✓ Circular, centralized, and edge-minimized forms are suitable for effect pigments.
- ✓ If the above are not possible, we recommend highly transparent effect pigments in low concentrations, like our Diamond or Dinastar series.



COMPARISON OF PARTICLE SIZES





CAST RESINS

The main field of application is unsaturated polyester resins and PMMA cast resins

- ✓ Kuncai effect pigments are easy to disperse in liquid casting resins by simple stirring.
- ✓ Depending on the size of the batch, a stirring time around 10 min gives a homogeneous pigment distribution.
- ✓ To prevent air from becoming trapped in the mixture, the powder form of effect pigments should be prewetted with an appropriate solvent.





SUMMARY

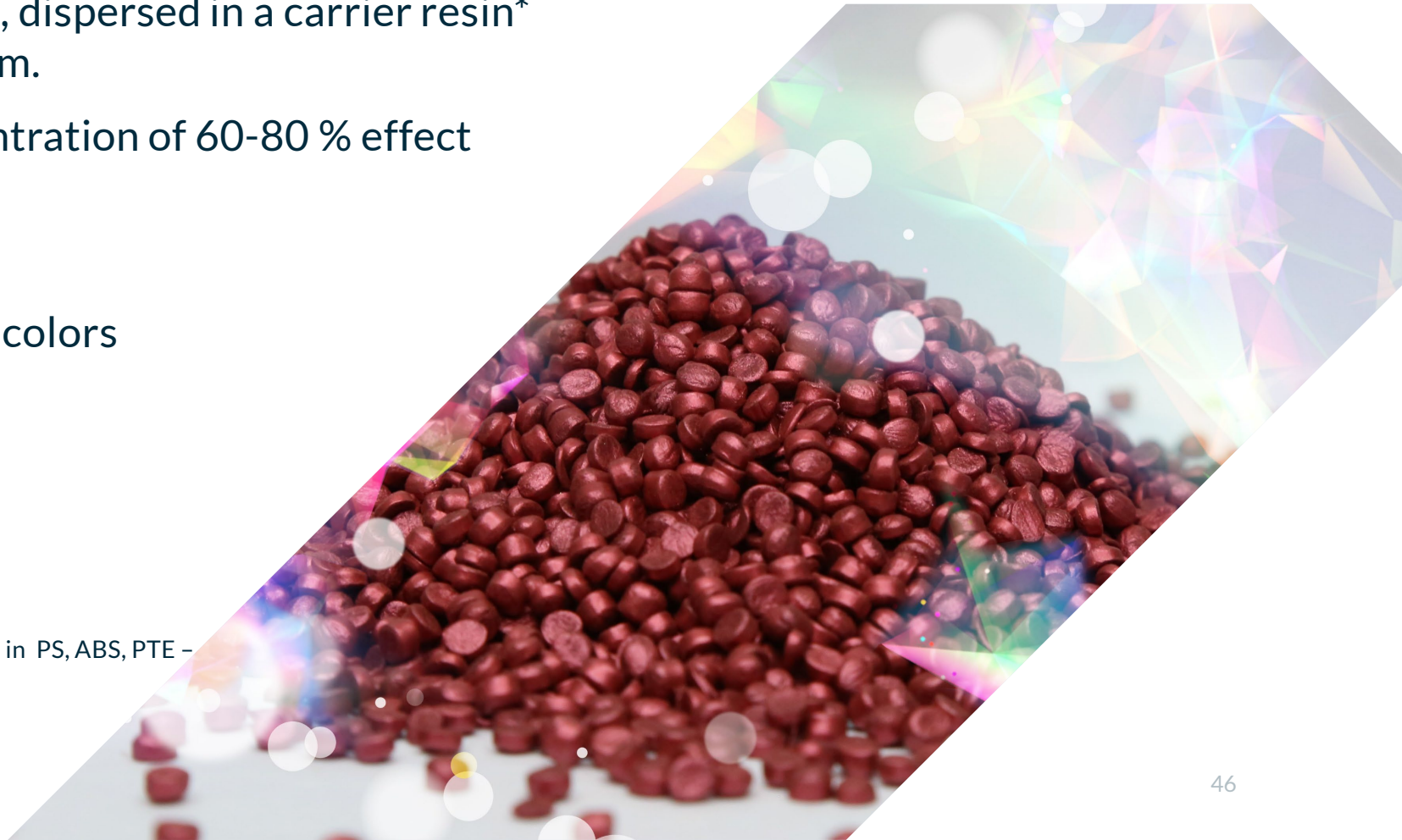
MPCs (Mono Pigment Concentrates)

Kuncaï's mono-concentrates contain a high concentration of a single effect pigment (60 – 80%), dispersed in a carrier resin* with a pellet size of 1 mm to 3 mm.

Our MPCs contain a high concentration of 60-80 % effect pigment loading in:

- Silver White
- Interference colors
- Gold
- Copper
- Chameleon

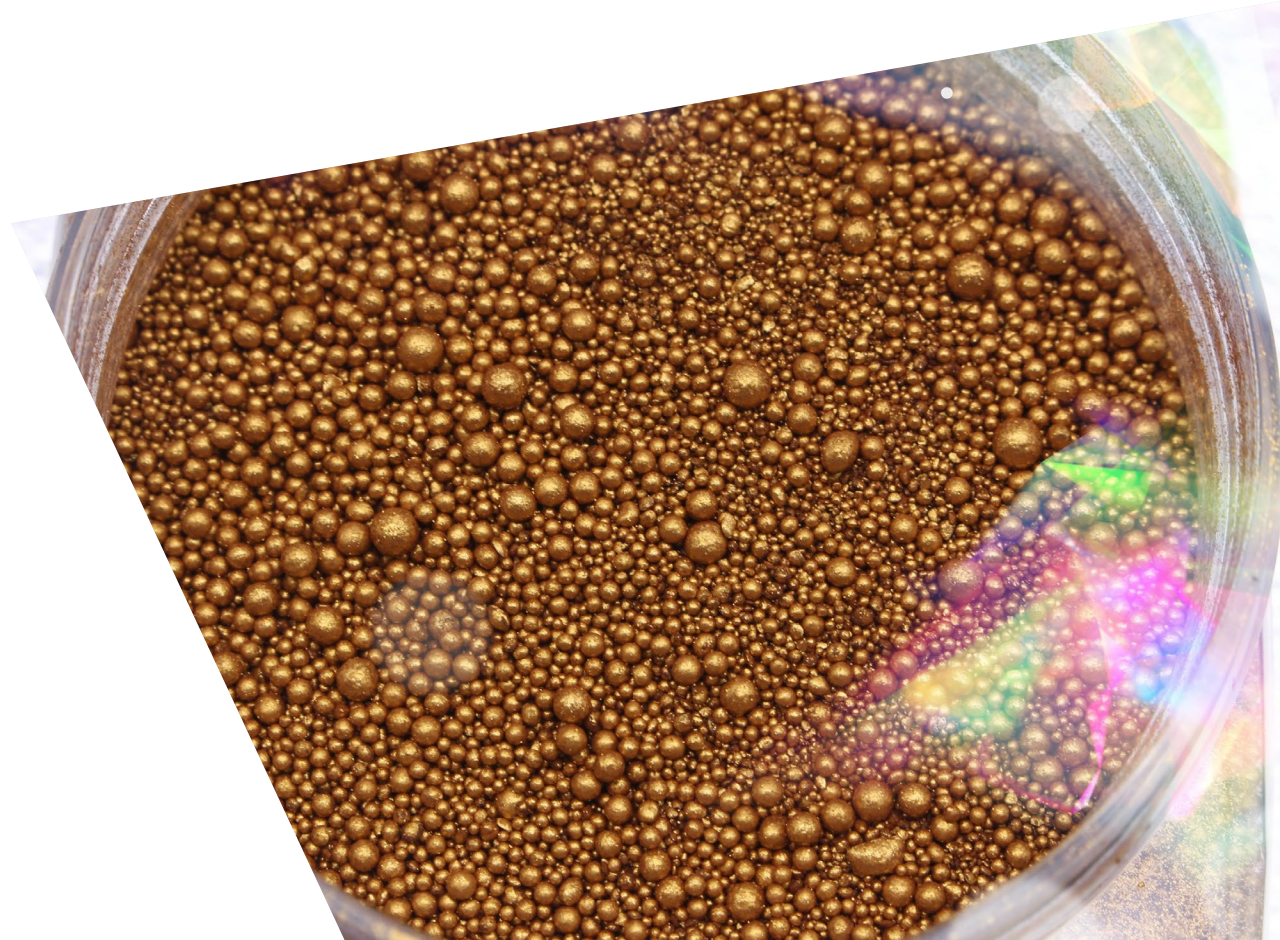
*Polyolefin (PE) or universal carrier (e.g. for application in PS, ABS, PTE – other carrier resins can also be customized)



WM - Pigment Preparations with Wax

- Pigment preparation of 70% KC Pearls and 30% PE wax.
- Product features:
 - Non-dusting
 - Better flow (feeding)
 - Higher throughput in the extrusion process

Most of our standard grades are available as WM grade, volume dependant.



KU – Anti-Yellowing Grades

These grades are especially treated to ensure non-yellowing in plastics after UV exposure.

- The following KU grades are available:
 - KC100KU
 - KC103KU
 - KC111KU
 - KC119KU
 - KC123KU

→ All grades have been officially approved by L'Oréal (statement is available)



WR – For Outdoor Plastics Applications

Product Features

- Final coating of the effect pigment with chromium hydroxide
- Excellent UV yellowing resistance
- Extremely high temperature resistance
- High humidity resistance

Application Properties

- Suitable for waterborne and solventborne systems
- Easily dispersible
- Suitable for exterior coatings due to excellent weather resistance properties
- Suitable for interior applications due to outstanding humidity resistance and UV resistance properties





READY TO PERFORM
Effect Pigments Mono Concentrates
Intermediate Products for
Masterbatch & Compounds

The cover features a vibrant, multi-colored geometric pattern in shades of purple, pink, and blue. In the foreground, several clear plastic containers are filled with small, colorful pigment granules in various colors including yellow, red, blue, and green. The KUNCAI logo is positioned in the top right corner.



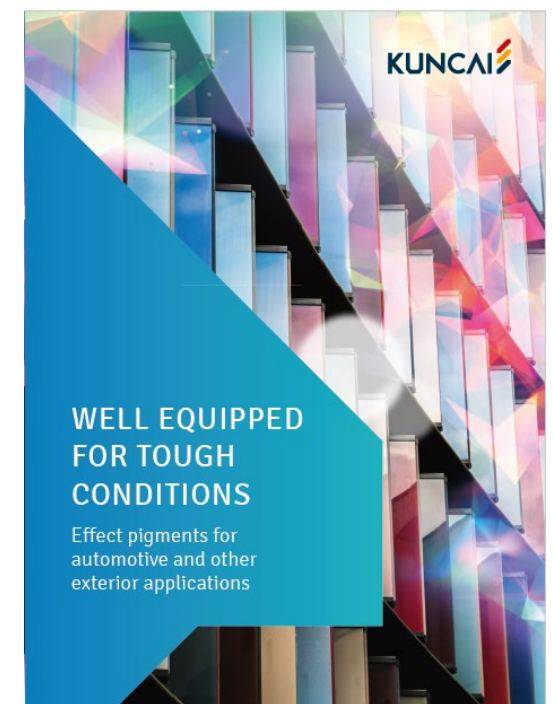
**EFFECT MONO
PIGMENT CONCENTRATES**
Sample Collection
Injection Moulding

This cover has a similar design to the first one, with a colorful geometric background and containers of pigment granules. A large, semi-transparent yellow and orange shape is overlaid on the bottom left, containing the text. The KUNCAI logo is in the top right corner.



**WELL EQUIPPED
FOR TOUGH
CONDITIONS**
Effect pigments for
automotive and other
exterior applications

The cover displays a grid of nine rectangular color swatches in various shades: white, light grey, dark grey, yellow, red, and blue. The background is a colorful geometric pattern. The KUNCAI logo is in the top right corner.



**WELL EQUIPPED
FOR TOUGH
CONDITIONS**
Effect pigments for
automotive and other
exterior applications

This cover features a large, semi-transparent blue and teal shape on the left side, containing the text. The background is a colorful geometric pattern. The KUNCAI logo is in the top right corner.

GOOD EFFECTS NEED...

- ✓ Transparent polymer
- ✓ Appropriate surface conditions
- ✓ No pigment damage
- ✓ Homogenous distribution of the platelets
- ✓ Good orientation



THANK YOU