

# Polymethyl methacrylate (PMMA)

An enabler for circular economy and design



Picture generated by Röhm GmbH/ Microsoft M365 Copilot

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## An enabler for circular economy and design

### Versatile across industries and applications:

- **Over 92% light transmission** for **optical clarity**. **High durability** and **weather resistance** for long-lasting outdoor functionality. **Around 50% lighter than glass, reducing weight without compromising strength**. High scratch **resistance**, up to **5H**.
- High purity polymer, suitable for **medical** applications.
- **Flexible product development** by easy thermoforming, machining, and colouring.
- Utilized in multiple industry sectors: automotive, medical and food, construction, electronics, and healthcare.

## Excellent UV resistance of Polymethyl methacrylate is a promoter for recyclability

Real-time



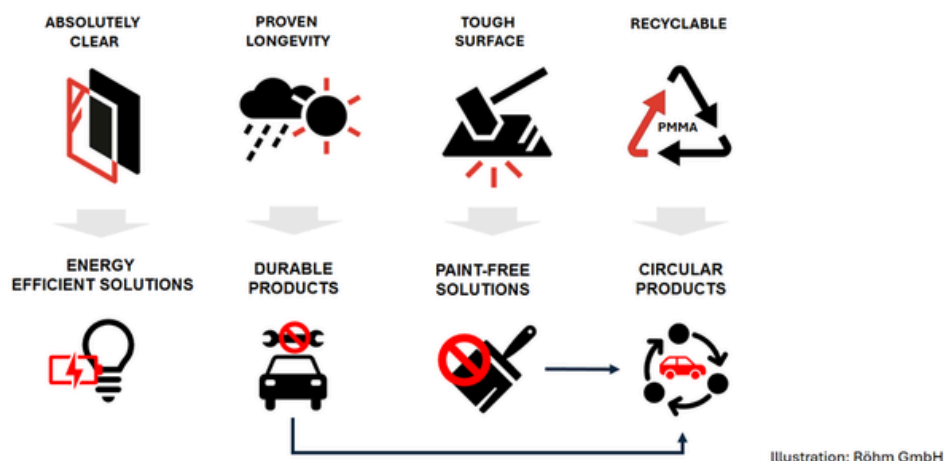
Picture: Röhm GmbH

- Excellent quality even after 15 years: No detectable yellowing, no loss in transparency and no degradation.
- Therefore, it can be recycled to high quality recyclates with low effort in additivation.

## Overview of PMMA recycling technologies

PMMA Waste Source	Examples	Mechanical Recycling	Chemical Recycling (Depolymerisation back to MMA)			Incineration	Comments
			Twin Screw Extrusion	Metal bath	Rotating Drum		
Artificial Marble	Sinks Decor Elements				PIR/ PCR	To be avoided	>50% inorganic fillers
Cast Material (all colors)	BLU Aircraft Windows		(PIR/ PCR)	PIR/ PCR	PIR/ PCR	To be avoided	PVC free
Injection molded/ Extruded part, Clear, colorless	Lenses Extruded Sheets	PIR/ PCR	PIR/ PCR	PIR/ PCR	PIR/ PCR	To be avoided	
Injection molded/ Extruded part, colored	Rear Lights Signage	PIR preferred	PIR/ PCR	PIR/ PCR	PIR/ PCR	To be avoided	
2-Component Parts	ABS/PMMA		Possible but low yield and critical side components depending on second material			recommended	Extended sorting and analytics required
Lumps and Sprues		Possible but not recommended	PIR	PIR	PIR	To be avoided	

## Products and their contributions to sustainability



## Dual recyclability

- Can be recycled **mechanically<sup>1</sup> and chemically**.
- **Post Consumer Recycling (PCR) compatible** – in alignment with emerging regulatory requirements in key markets.
- Circular PMMA products are already commercially available (segregated and mass-balanced approaches, ISCC Plus certified according to ISO 22095).

<sup>1</sup>Excluding cast

## Chemical Recycling of PMMA

### Polymer → Monomer → Polymer

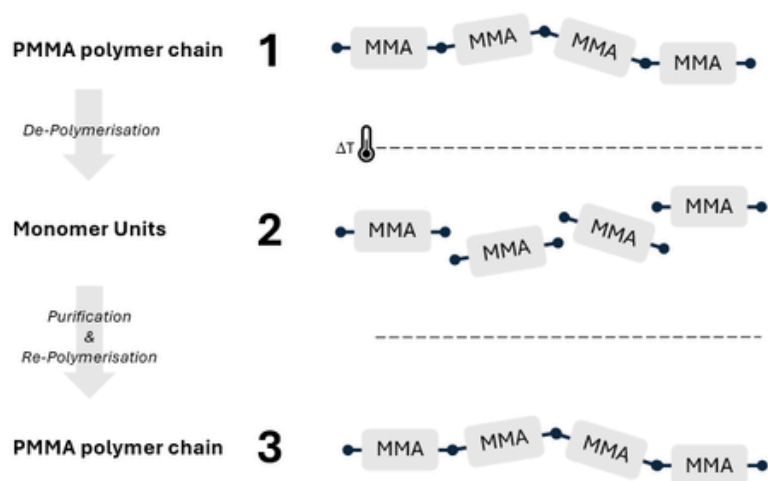


Illustration: Röhm GmbH

- **Flexible sourcing** - circular products possible with **segregated or attributed recycled content**.
- **Highly suitable** for **chemical recycling** through **depolymerisation**.
- **Molecular structure** - allows **near quantitative depolymerisation** (thermolysis) **back to its monomers (MMA)**. **Highly efficient process** - Depolymerisation works well **alongside other recycling methods**, such as back-to-oil routes, making it **versatile for circular economy strategies**.
- **High-purity MMA from recycled PMMA** - The recovered monomer is of high quality, enabling its reuse in new PMMA production **without compromising performance**.
- **Significant PCF reduction** - Compared to producing virgin MMA and PMMA, this process can cut the Product Carbon Footprint (**PCF**) **by more than 80%**.

## PMMA – recycling data in a nutshell

Recycling process	Volumes	Yield	Product Quality and Flexibility	PCF reduction compared to virgin MMA/PMMA production
Mechanical	Mainly PIR	Depend on sorting process	Good quality from injection and extrusion scrap	90+% (PMMA) <sup>2</sup>
Chemical	PIR and PCR	90+% <sup>2</sup>	High to premium quality. Nearly same flexibility as virgin grades.	80 – 90+% (MMA) <sup>2</sup>

### Design of recyclable and repairable products with PMMA

- **Products can be assembled using different methods** — screws, and click-fit connections preferred to welding and bonding. This modular approach **supports circular design**, as parts can be easily disassembled and reused. **Monomaterial design** for simplified recycling.
- PMMA has a hard surface and can be coloured directly so painting isn't required. This reduces **VOC emissions** (volatile organic compounds) and **CO<sub>2</sub> footprint** during manufacturing of injected, extruded, or cast parts.
- Adding **material markers** ("PMMA" label) and printed protective films enables recyclers to **correctly identify** the material, ensuring it **enters the correct recycling stream**.

<sup>2</sup> Simon van der Heijden, Pascal Lakeman and Jean-Luc Dubois – "PMMA Circularity Roadmap - Industrial Practice and Academic Insight", second edition available from DeGruyter (2025), <https://doi.org/10.1515/9783111076997>