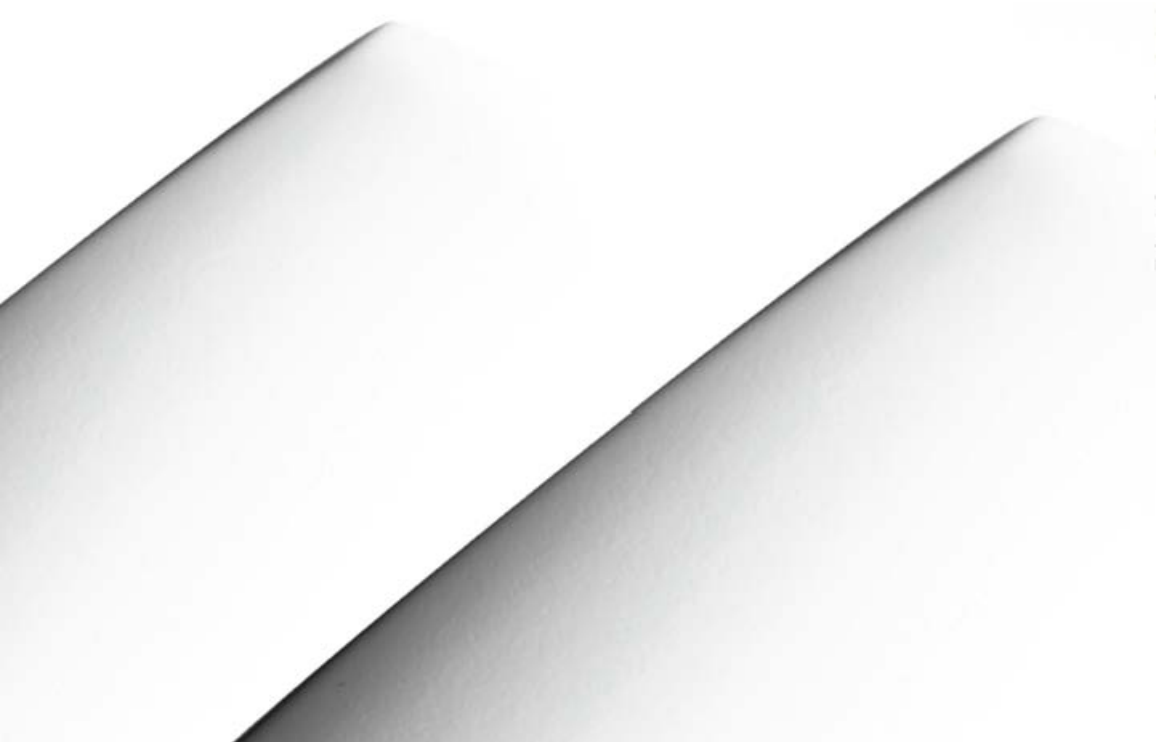
WHAT YOU NEED TO KNOW ABOUT ABS RESINS

the advantages of producing the material with mass polymerization technology



Jon Baldwin
Engineer, Plastics TS&D
Midland, Michigan

September 25, 2019
10:00 am EST

Fast Facts

We Are Trinseo

- Trinseo is a global materials solutions provider and a manufacturer of plastics, latex binders, and synthetic rubber.
- The company delivers innovative and sustainable solutions to help customers create products that are intrinsic to how we live – products that touch lives every day across a wide range of end markets, including automotive, consumer electronics, appliances, medical devices, lighting, electrical, carpet, paper and board, building and construction, and tires.

A Strong Track Record − A Bold Direction

$4.6
BILLION REVENUE
IN 2018

2,500
EMPLOYEES
IN 25 COUNTRIES

16
MANUFACTURING
SITES GLOBALLY

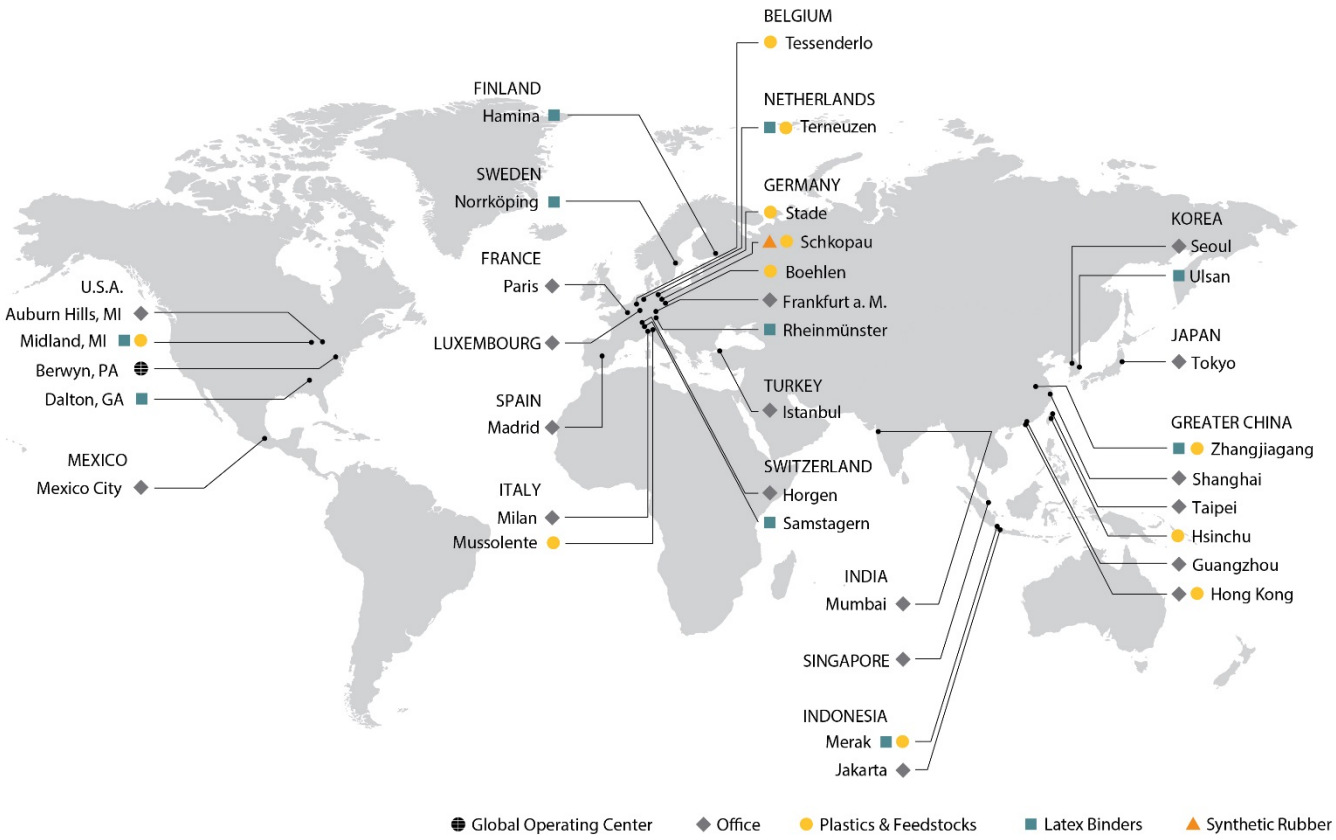
11
R&D FACILITIES

Corporate Overview

	Latex Binders	Synthetic Rubber	Plastics		
Products	Styrene Butadiene (SB) Latex Binders Styrene Acrylate (SA) Latex Binders Starch Containing Emulsion (SCE) Latex Binders	Solution-Styrene Butadiene Rubber (S-SBR) Neodymium-Butadiene Rubber (Nd-BR) Emulsion-Styrene Butadiene Rubber (E-SBR) Nickel-Butadiene Rubber (Ni-BR)	Acrylonitrile Butadiene Styrene (ABS) Polycarbonate (PC) blends PC/ABS PC/PET Long-Glass-filled Polypropylene Glass-filled Alloys Polypropylene compounds General Purpose Polystyrene	High Impact Polystyrene (HIPS) Acrylonitrile Butadiene Styrene (ABS) Resins Styrene Acrylonitrile (SAN) Resins Polycarbonate Resins (PC) Thermoplastic Elastomers (TPE) Thermoplastic Polyurethanes (TPU) Bio-based and/or biodegradable Plastics	
Brands	ENVERSA™ Technology Modifier A™ / NA Binder LOMAX™ Technology LIGOS™ Binders VOLTABOND™ Binders	BUNA™ Synthetic Rubber SPRINTAN™ Synthetic Rubber	CALIBRE™ CALIBRE™ MEGARAD™ CELEX™ EMERGE™ PC EMERGE™ PC/ABS EMERGE™ PC/PET ENLITE™ INSPIRE™ TYRIL™	MAGNUM™ PULSE™ VELVEX™ MEGOL™ TPE-S APIGO™ TPO NEOGOL™ OBC TIVILON™ TPV RAPLAN™ TPS API L™ TPC	APINAT™ BIO TPC APINAT™ F BIO TPE MEGOL™ BIO TPE-S APIGO™ BIO TPO APILON™ 52 BIO TPU APILON™ 52 TPU APILON™ 52C TPU STYRON A-Tech™ STYRON C-Tech™ STYRON X-Tech™
End Use	Adhesives Construction Functional Nonwovens Paper & Board Textiles & Carpet	Performance Tires Standard Tires Technical Rubber Goods	Automotive Building & Construction Consumer Electronics Consumer Goods Edgebands Electrical	Home Appliances Lighting Medical Devices Packaging Sheet & Profile Extrusion Footwear	

Global Manufacturing Locations

Trinseo delivers an unmatched combination of global reach, operational excellence, expertise, leading intellectual property, world-scale assets, and global R&D presence.



Jon Baldwin

- Member of Technical Service & Development (TS&D) team
- Provides technical expertise and support for Performance Plastics business including MAGNUM™ ABS
- Previously with Techmer PM, a specialty compounder as well as PolyOne and Standridge Color Corporation
- Materials science and engineering degree from the Georgia Institute of Technology.
- Works virtually from the Atlanta area
- Aligned with plastics team and ABS production plant in Midland, Michigan

Agenda

- MAGNUM™ ABS Overview
- Comparison of ABS produced with mass polymerization vs. An emulsion method
- Benefits of mass ABS
- Quality Control
- Summary of advantages of mass vs. emulsion
- Q&A

MAGNUM™ ABS Resins

Produced with mass polymerization technology vs. an emulsion method

Offers significant benefits to OEMs in both extrusion and injection molding applications

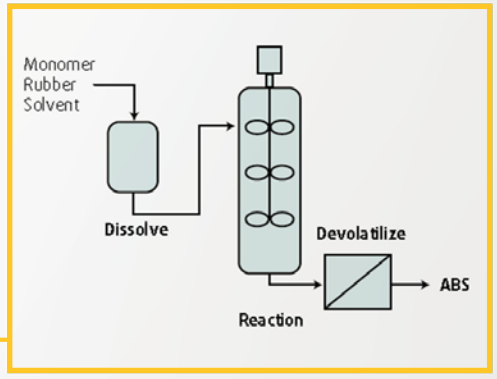
- Colorability
- UV and Thermal Stability
- Low VOCs
- Gels

Able to meet the needs of a variety of applications ranging from automotive to medical devices to consumer products

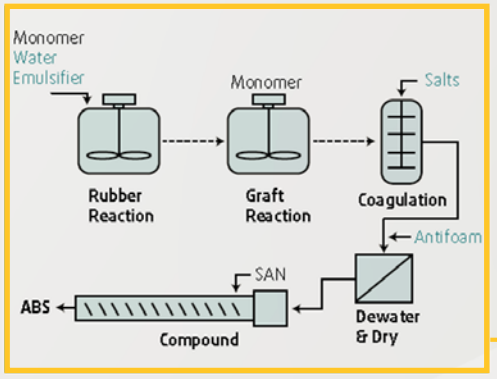
ABS Production Methods – that yield different properties

- Continuous process
- Consistent product
- Few additives

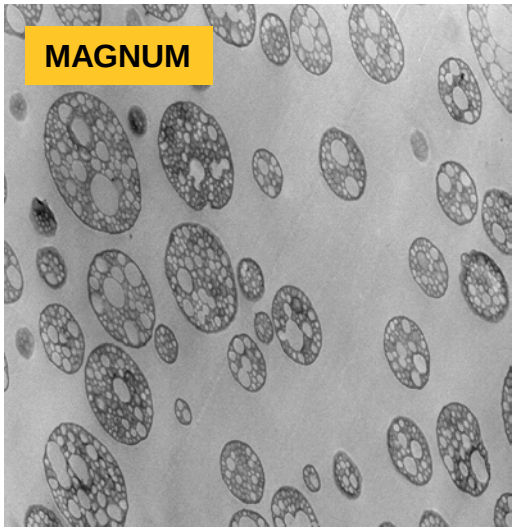
Mass Polymerization Process

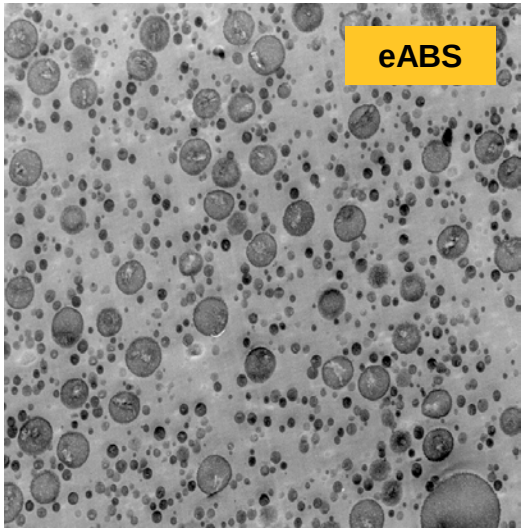


Emulsion Polymerization Process



- Batch process
- More lot variation
- Emulsifier, coagulant, antifoam

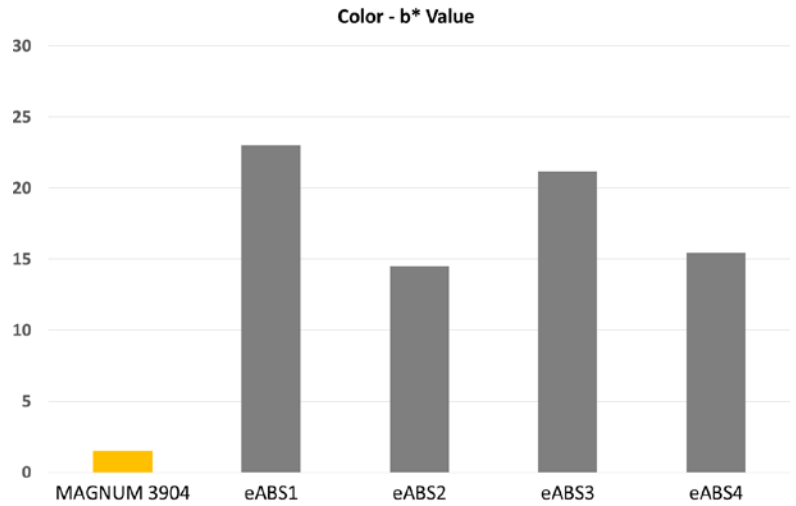




1µm

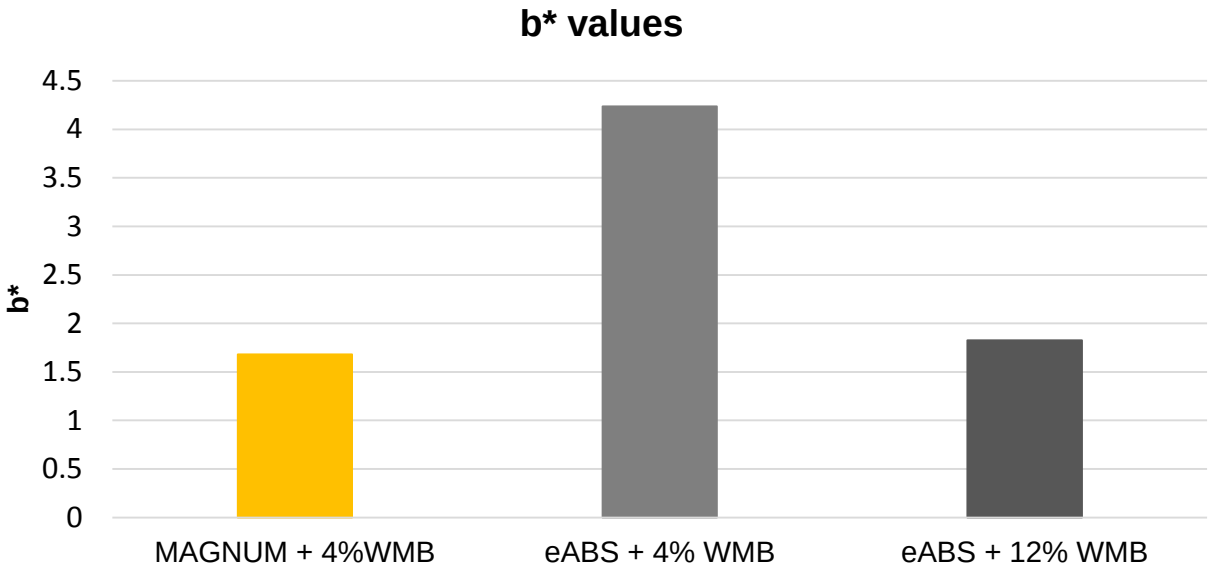
ABS Comparative Study

Color Comparison



ABS Comparative Study

Coloring with White Masterbatch

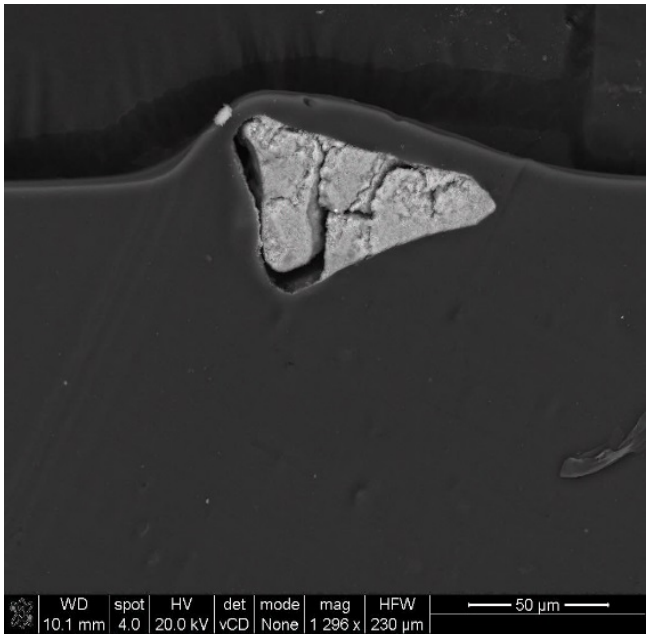


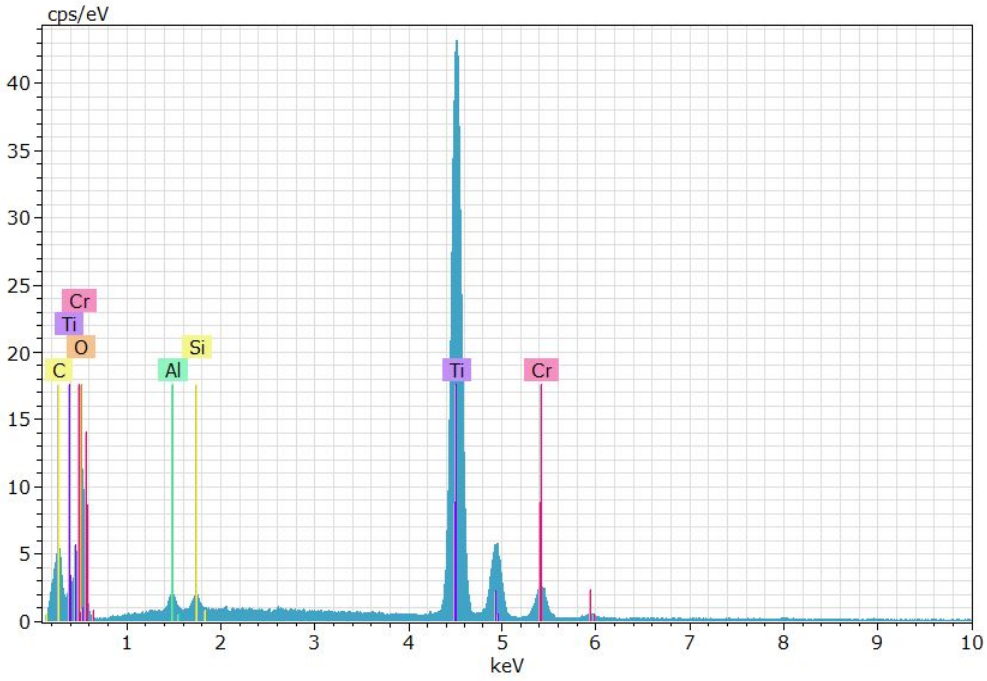
WMB = White Masterbatch, contains 50% TiO_2

	Cost to color WMB ~ 4 $/lb	Falling Dart Impact Total Energy (J)	Density (kg/l)
Magnum + 4% WMB	0.16 $/ lb	26.7	1.124
eABS + 12% WMB	0.48 $/ lb	22.7	1.230
Delta	+0.32 / lb	-15%	+9.4%

ABS Comparative Study

Coloring with TiO_2





ABS Comparative Study

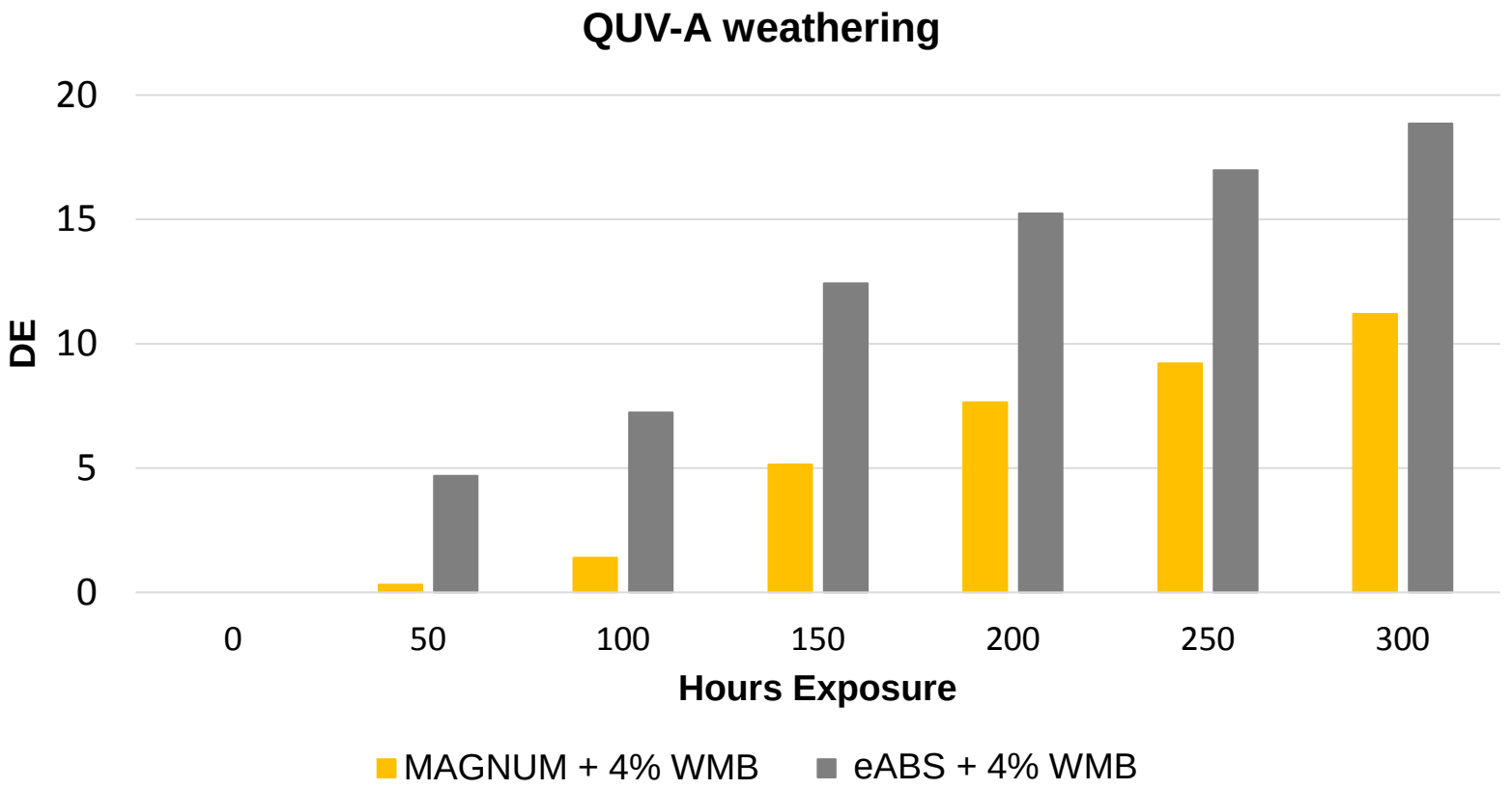
Coloring with 3% Green Masterbatch

Emulsion ABS

MAGNUM™ ABS

Comparative Study

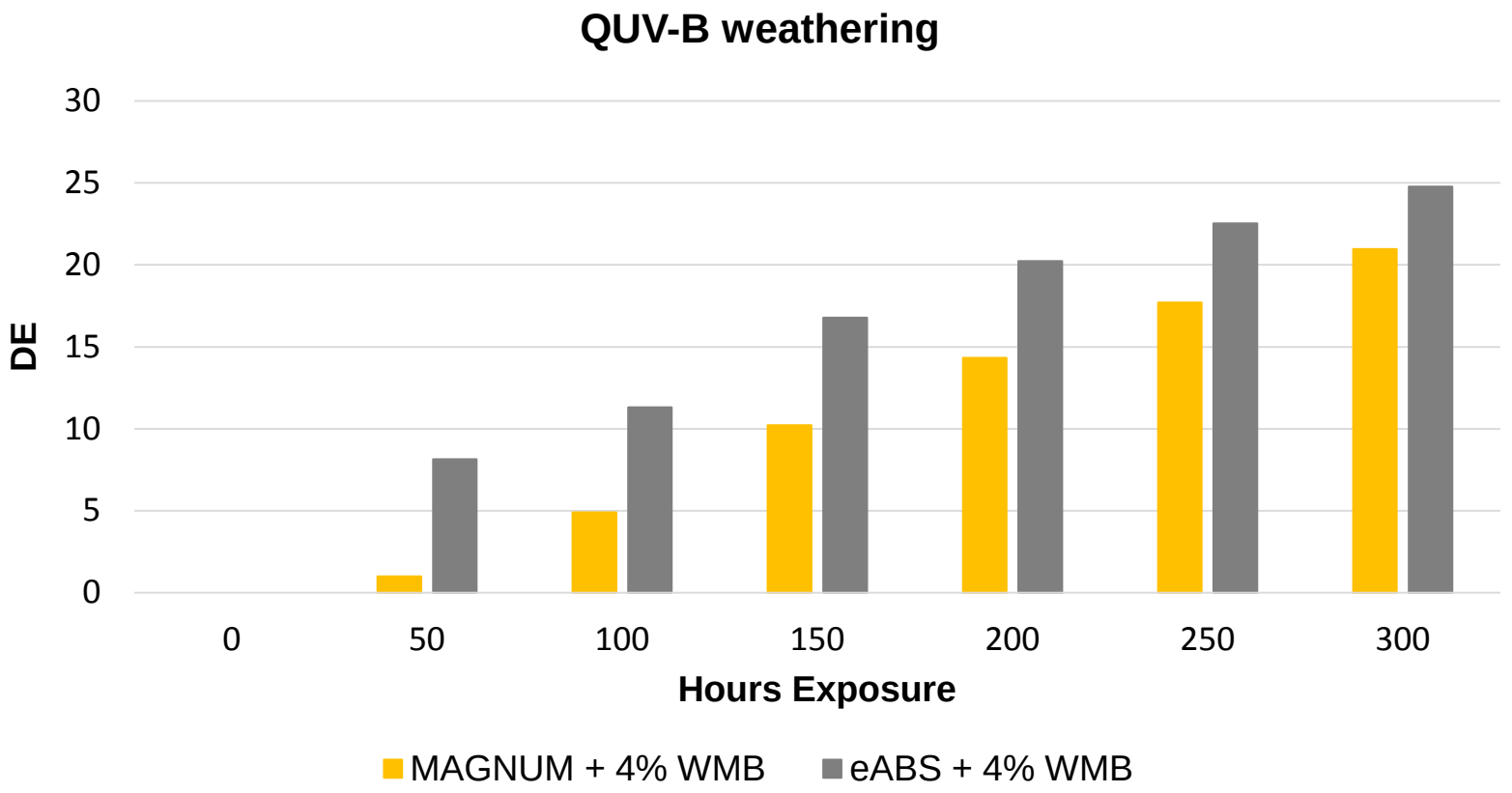
UV Stability



50% slower aging

Comparative Study

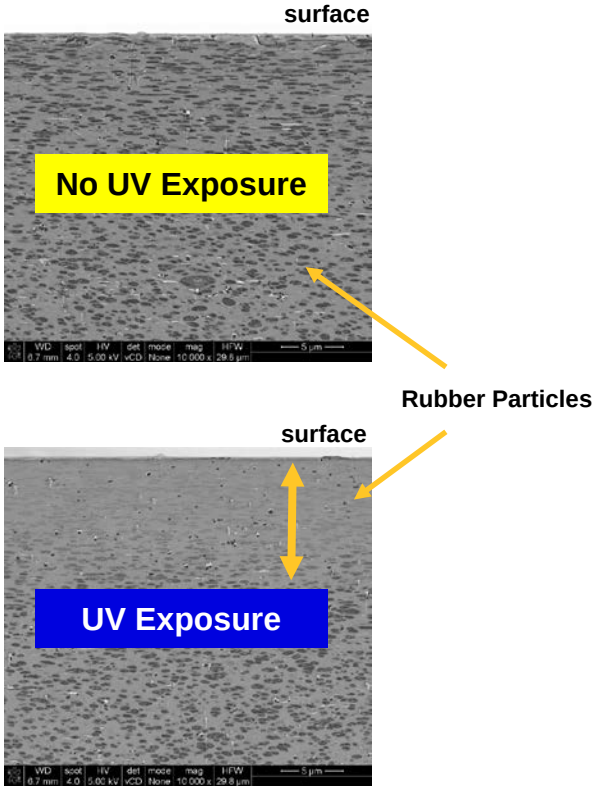
UV Stability

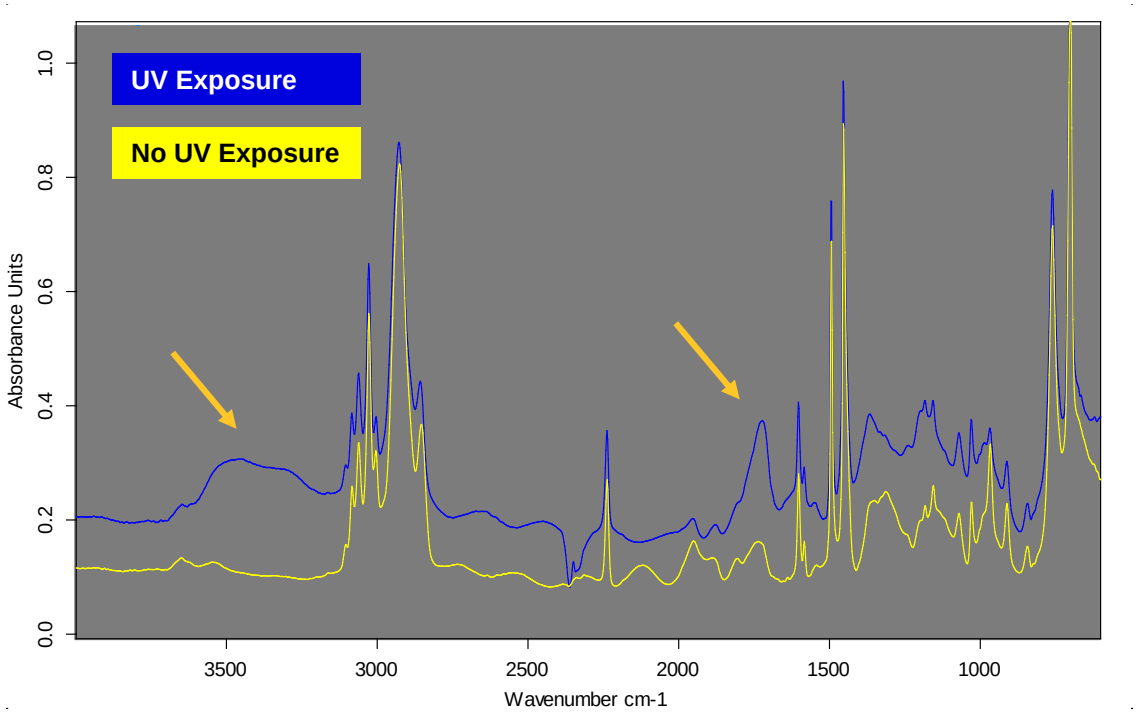


30% slower aging

ABS Resin Attributes

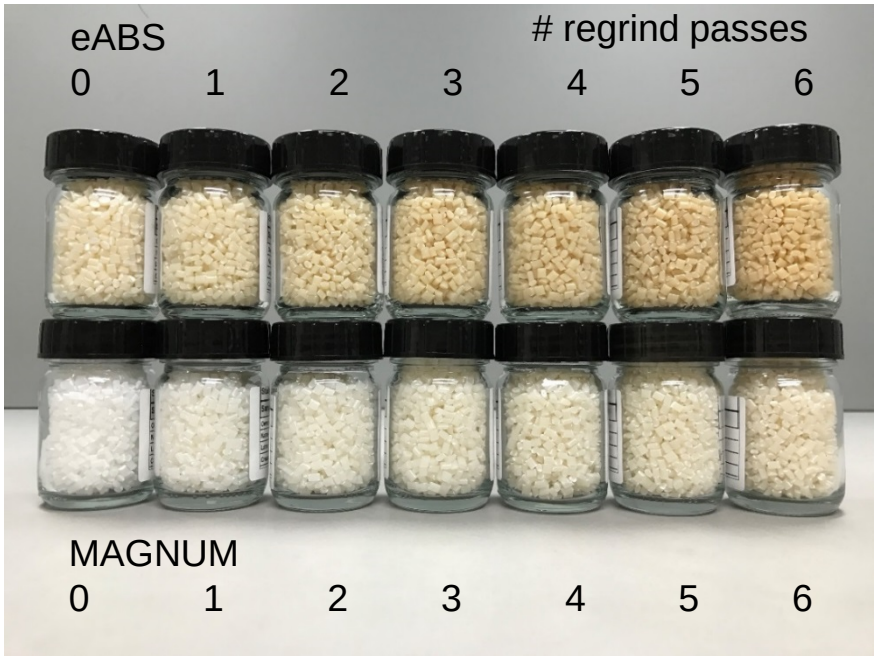
UV Stability

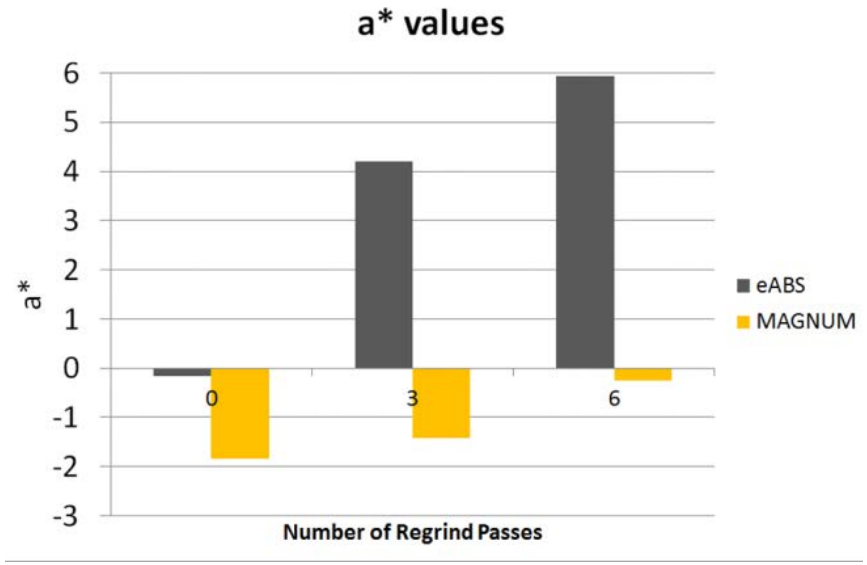




ABS Comparative Study

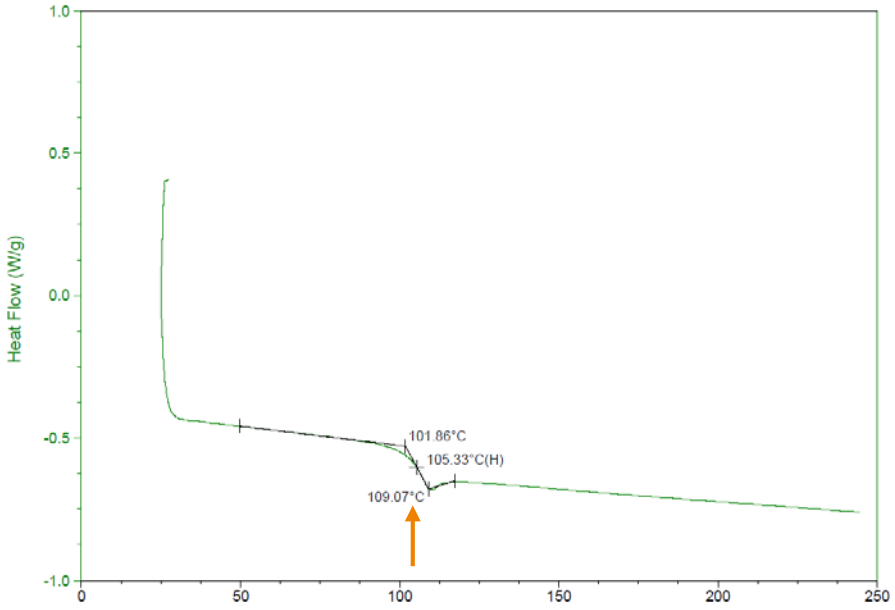
Thermal Stability



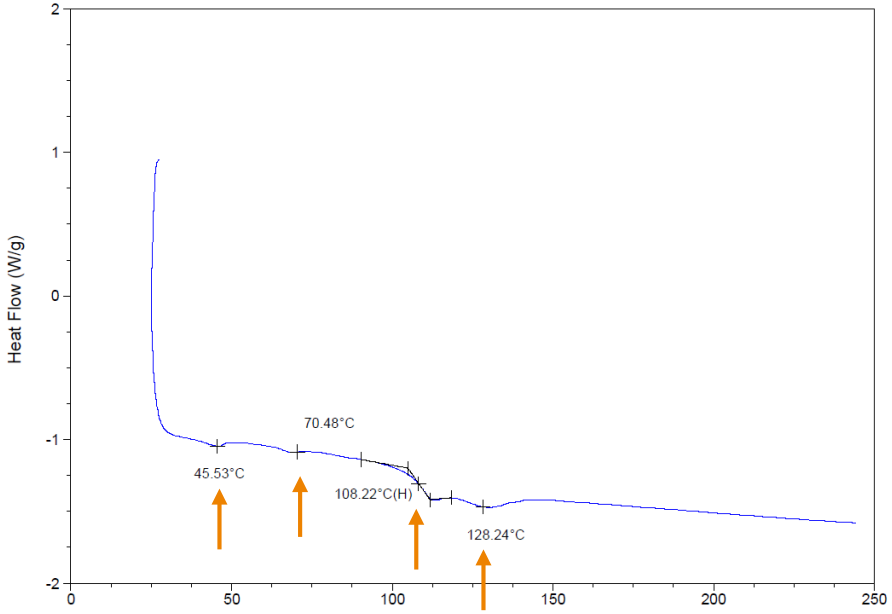


ABS Comparative Study

Product Purity



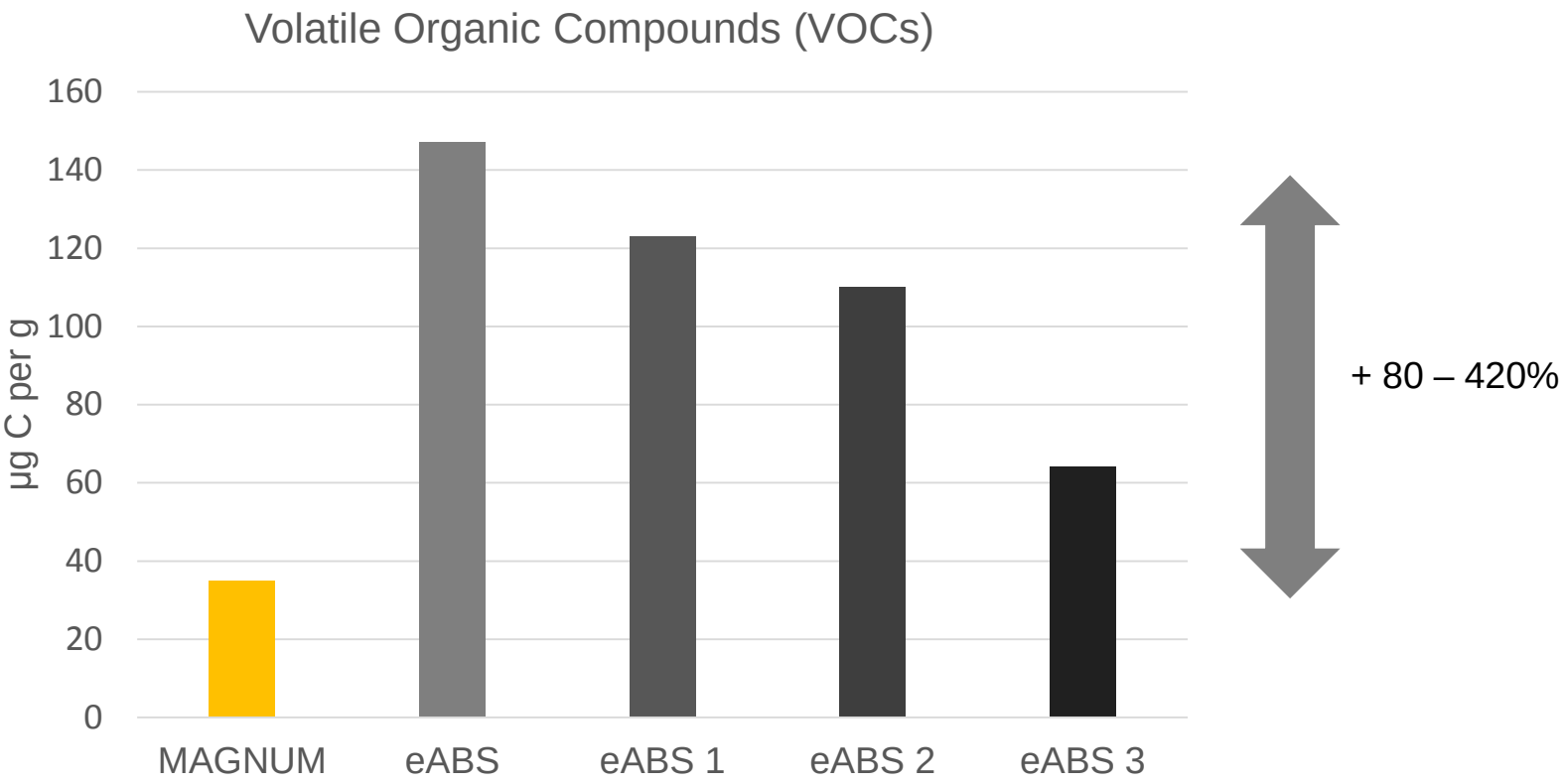
MAGNUM



eABS

ABS Comparative Study

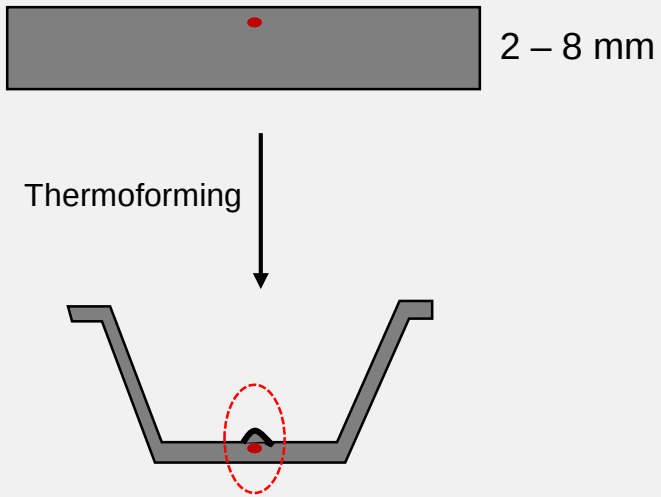
Volatile Organic Compounds



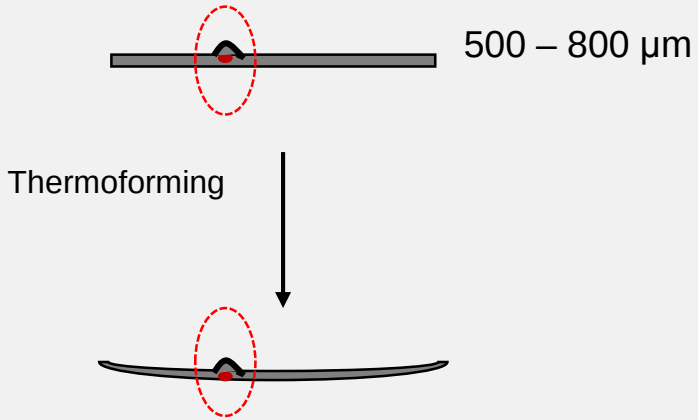
ABS Resin Attributes

Unmelts/Gels

Sheet Extrusion

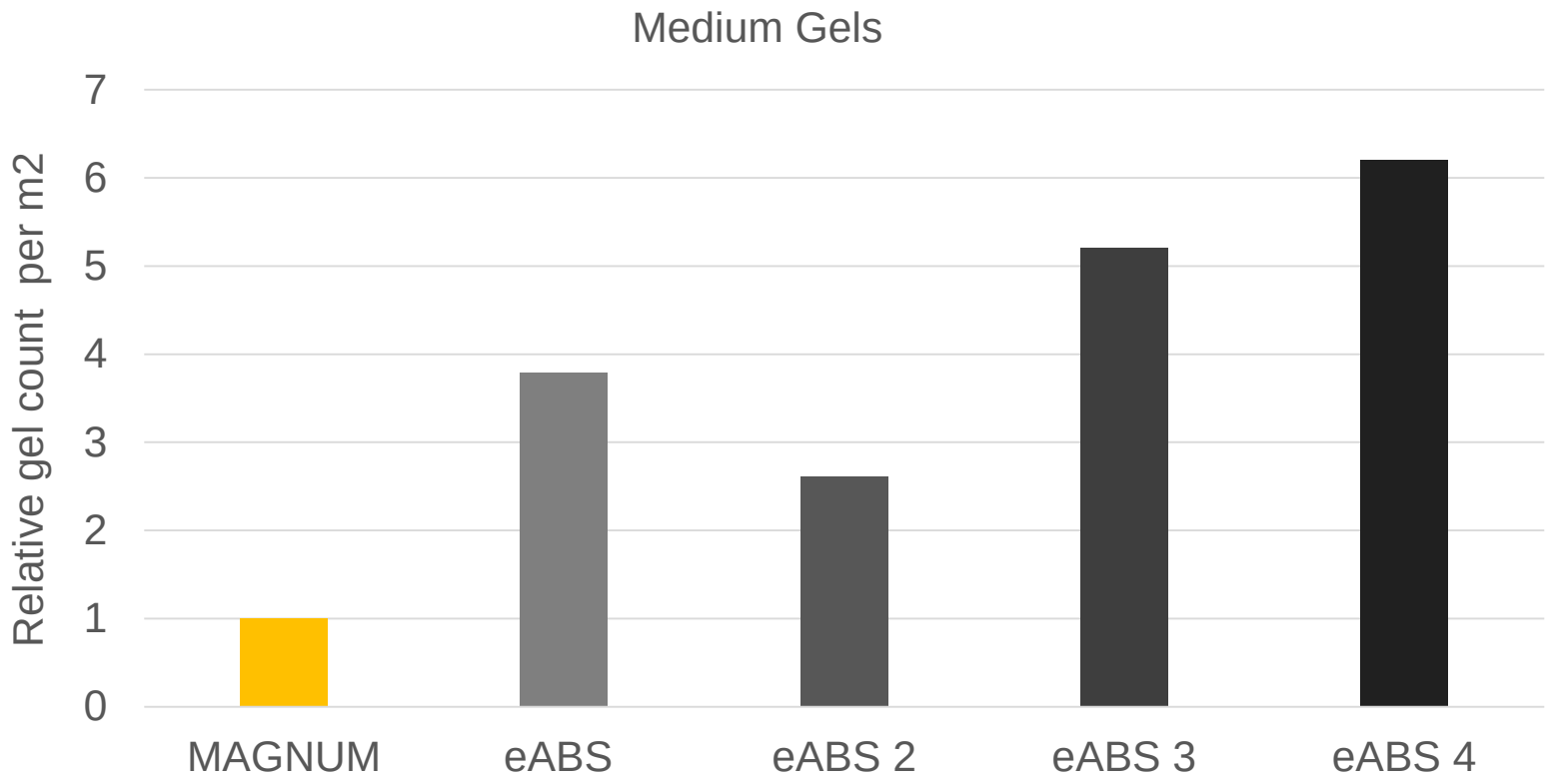


Film Extrusion



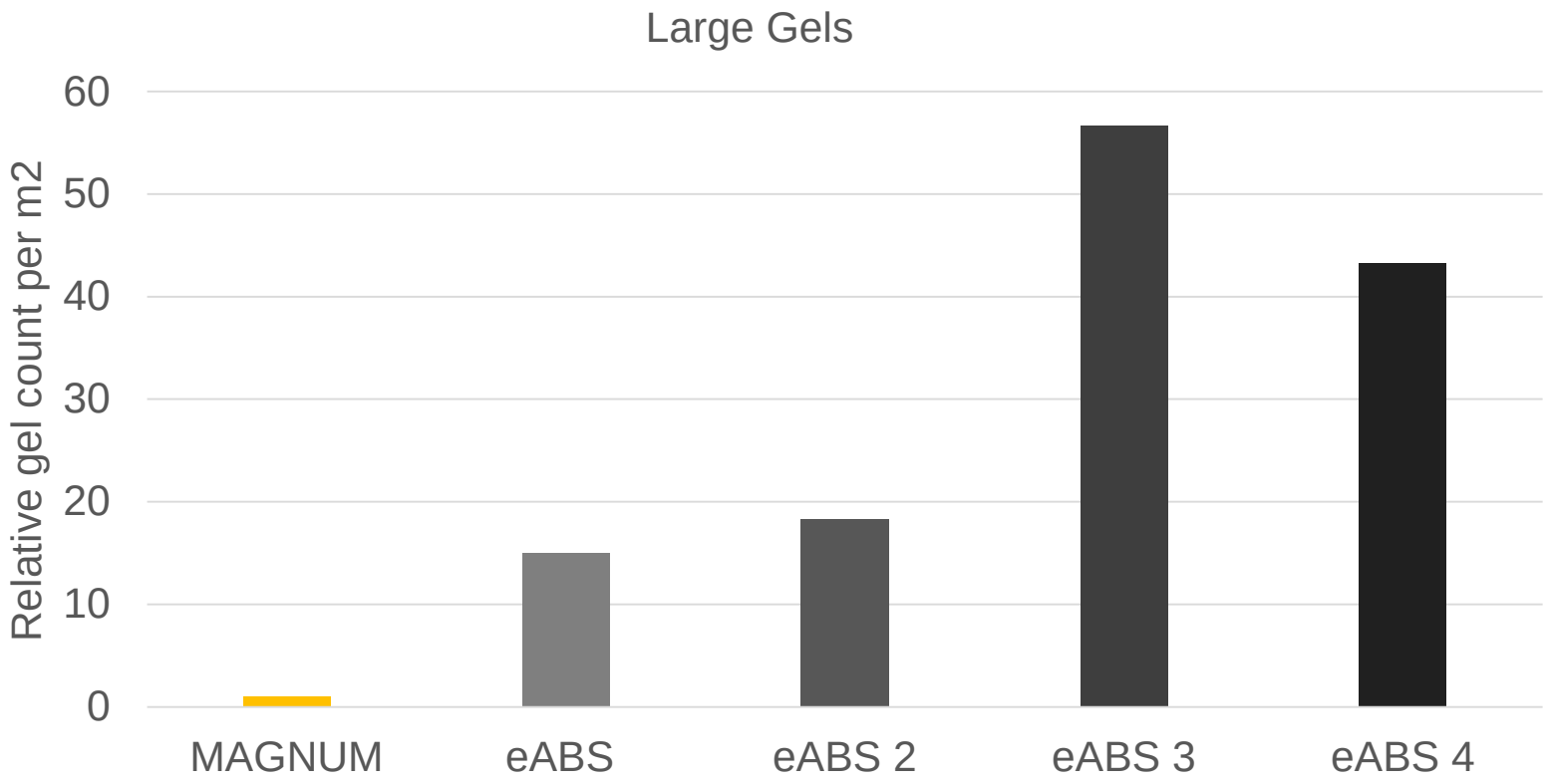
ABS Comparative Study

Low in Gels



ABS Comparative Study

Low in Gels

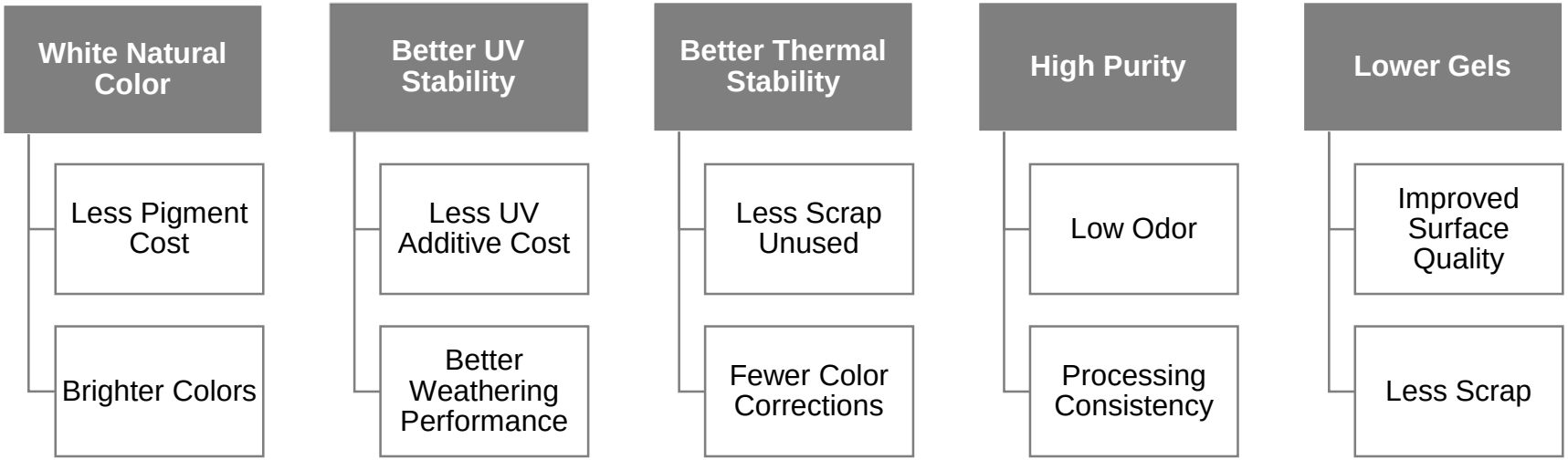


Trinseo Quality Control

Low in Gels

ABS Comparative Study

Advantages of Mass ABS



MAGNUM™ ABS Grades

	Product	MFR (220 °C / 10 kg)	Vicat (50 °C/h, 5 kg)	Izod (notched, 23 °C)	Major Characteristics
Standard ABS Grades	MAGNUM 3904	4.7	97	10	**Extra high impact**, ABS for extrusion, featuring good processability and medium heat resistance
	MAGNUM 3504	5.2	102	6	Medium flow, combining good impact with medium-high heat resistance. Low base color, ideal for self coloring.
	MAGNUM 3404	6.6	102	4	Medium impact, general purpose ABS for extrusion featuring excellent processability and **medium-high heat resistance**
	MAGNUM 555	8	98	8	High impact and medium-high gloss, general purpose ABS for extrusion or injection molding
	MAGNUM 275	8	99	5	Medium impact, general purpose ABS for extrusion or injection molding
	MAGNUM 3513	8.5	102	6	Combines **good flow and medium-high impact**
	MAGNUM 8434	13	101	5	**High gloss and medium-high heat** performance, with medium impact resistance.
	MAGNUM 3453	15	97	4	**Medium impact** with **above medium flow** and medium heat resistance.
	MAGNUM 8391	27	95	4	**Highest flow rate and gloss ABS** resin in our product offering, with medium impact resistance.

MAGNUM™ ABS Grades

	Product	MFR (220 °C / 10 kg)	Vicat (50 °C/h, 5 kg)	Izod (notched, 23 °C)	Major Characteristics
Special ABS Grades	MAGNUM 3404 SMOOTH	6.6	102	4	Very low particle content for superb surface finish, provides the highest purity and low gel level
	MAGNUM 3404 ULTRA SMOOTH	6.6	102	4	Ultra low particle content for superb surface finish, provides the highest purity and lowest gel level
	MAGNUM 3904 SMOOTH	4.7	97	10	Very high impact, very low particle content for superb surface finish, provides the highest purity and lowest gel level
	MAGNUM 3904 SMOOTH LP	4.5	97	8	Very high impact, highest purity and low gel level. Lower plate-out content for a cleaner surface.
	MAGNUM 3904 ULTRA SMOOTH	4.7	97	10	Very high impact, ultra low particle content for superb surface finish, provides the highest purity and lowest gel level
	MAGNUM MATT	6.5	100	4	Ultra low gloss surface finish, with mechanical properties close to MAGNUM 3404

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Thank you!