TRINSEO

MATERIALS **MATTER**

MAGNUM™ ABS FOR MEDICAL APPLICATIONS | Cheryl Weckle| DATE: July 11, 2018

10:00 AM EST

Corporate Facts

$3.7 Billion
in net sales (2016)

16 Manufacturing sites

Major business divisions
Performance Materials including Latex Binders and Rubber and Basic Plastics and Feedstocks

25 Countries

2200 Employees

TRINSEO

Trinseo Plastics Business

Basic Plastics and Feedstocks

Basic plastics

GPPS/HIPS polystyrene (PS)

Acrylonitrile butadiene styrene (ABS)

Styrene acrylonitrile (SAN)

Polycarbonate (PC)

Performance Materials

Performance plastics

ABS Compounds

PC / ABS Blends

PC / PET Blends

Specialty Products
- Ignition resistant
- Filled materials
- Other properties

TRINSEO

Cheryl Weckle

- Senior development scientist for Trinseo's plastics business focusing on medical applications. Working globally, she leads medical resin development projects for some of the world's largest OEMs.
- 29 years in the plastics industry
- Today she'll discuss and compare the methods of producing ABS – a traditional emulsion method and the alternative mass polymerization process. She'll also address how the material is being used for medical applications and the benefits of the polymer

TRINSEO™

Agenda

- Trinseo Medical Portfolio
- ABS Applications and Features
- Mass versus Emulsion Polymerization
- Comparative Study of Performance Properties
  - Base resin color
  - Lot to lot consistency
  - Color stability
  - Thermal stability
  - UV stability
  - Purity
  - VOC's
- MAGNUM™ ABS Products and Medical Offering

TRINSEO™

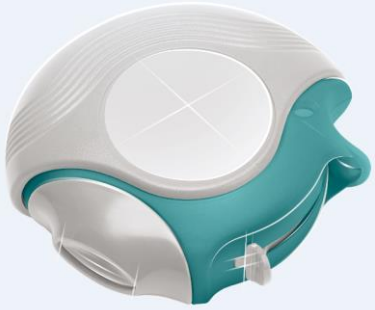
Plastics Offered for Medical Applications

Resin Family		Features	Applications
CALIBRE™ PC		• Transparent • Opaque • Custom-made color • Biocompatibility	• Fluid and drug delivery: syringes, stopcocks, luers • Surgical devices, handles
CALIBRE™ Glass-filled PC		• Opaque • High rigidity • Biocompatibility	• Surgical devices: handles and housings
CALIBRE™ MEGARAD™ PC		• Transparent • Gamma & E-beam radiation resistance • Biocompatibility	• Fluid & drug delivery: syringes, stopcocks, luers • Renal care: blood filter housings, dialyzer housings
EMERGE™ PC/ABS & PC/PET		• PC/ABS & PC/PET Blends • Outstanding chemical resistance • Ignition resistance • Limited Biocompatibility	• Equipment Housings • Monitoring devices • Diagnostic equipment
MEGOL™ TPE-S RAPLAN™ TPE-S		• Good adhesion • Excellent aesthetics • Tailor made to customers' needs	• Over-molding • Soft touch grips • Drip chambers
MAGNUM™ ABS		• Superior natural whiteness • Low volatile organic compounds • Excellent lot-to-lot consistency	• Portable device housings: diabetes management equipment, glucose meters, insulin pens

TRINSEO™

Typical Medical ABS Applications

Metered Dose Inhaler



Accuhaler

Glucose Monitor

Pen Injector

Auto-Injector

Syringe Barrel

TRINSEO

Why ABS?

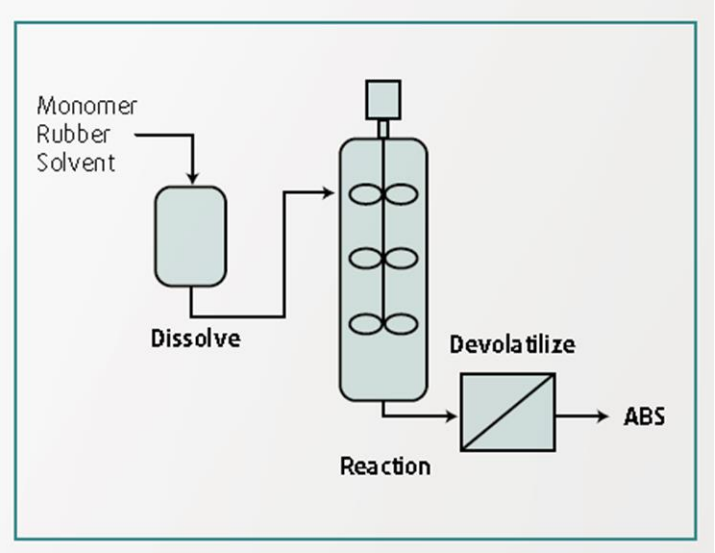
ABS Polymer = Acrylonitrile + Butadiene + Styrene

- Lower Cost
- Easy to Process
- Good Toughness
- Medium Heat Resistance
- Easily Colorable
- Good Aesthetics
- Sterilizable by EtO, gamma and e-beam

TRINSEO™

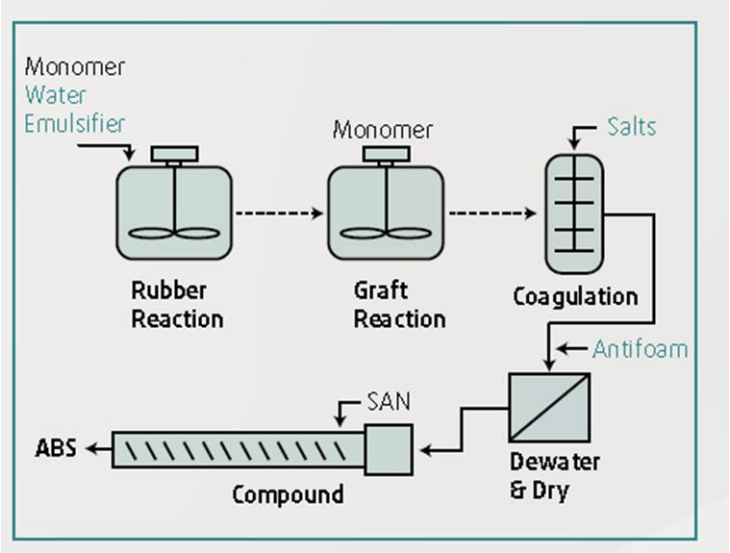
ABS Production

Mass Polymerization Process



- Continuous process
- Consistent product
- Few additives

Emulsion Polymerization Process

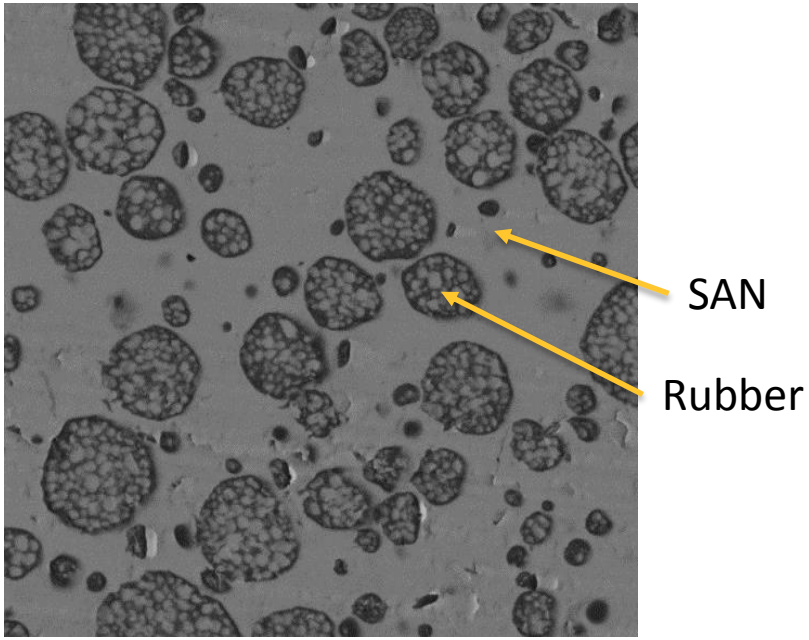


- Batch process
- More lot variation
- Emulsifier, coagulant, antifoam

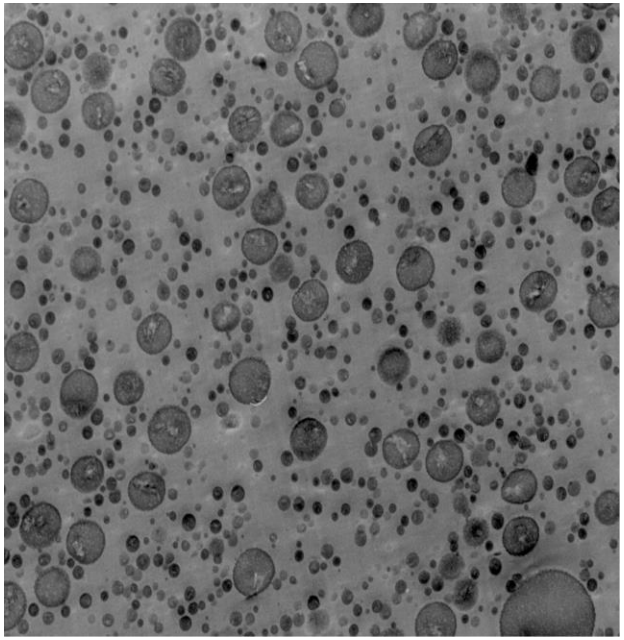
TRINSEO

Comparative Study

Mass ABS

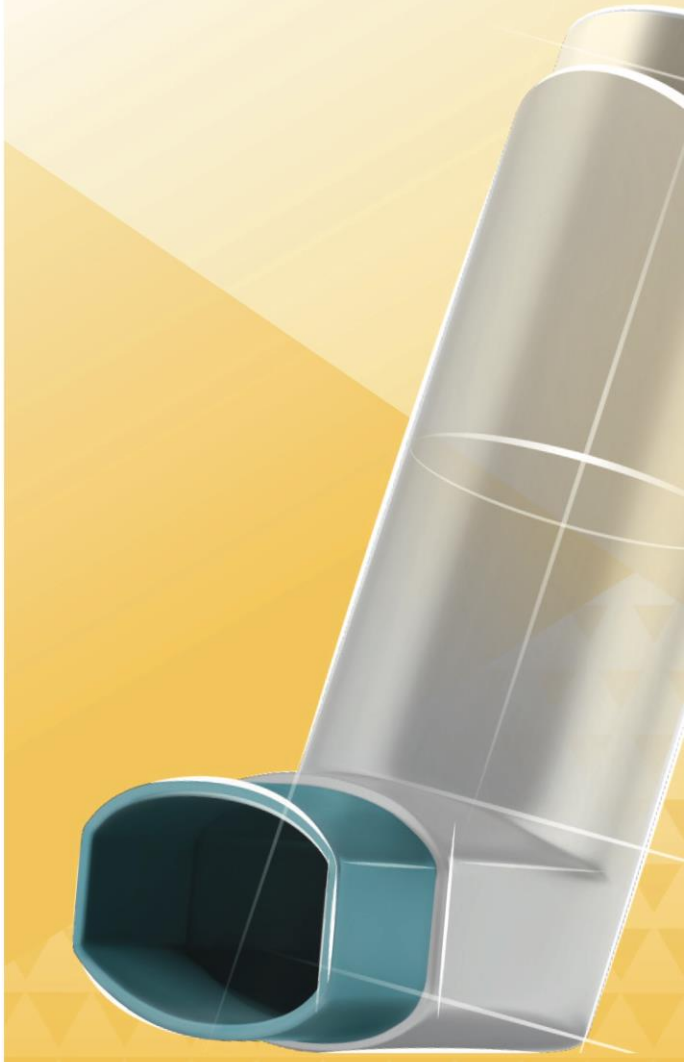


Emulsion ABS



TRINSEO

	Mass ABS	Emulsion ABS
Continuous manufacturing process	✓	✗
Lot-to-lot consistency	✓	✗
Color consistency	✓	✗
White base color	✓	✗
Ease of self-coloring	✓	✗
Low gel level	✓	✗
Low residuals	✓	✗

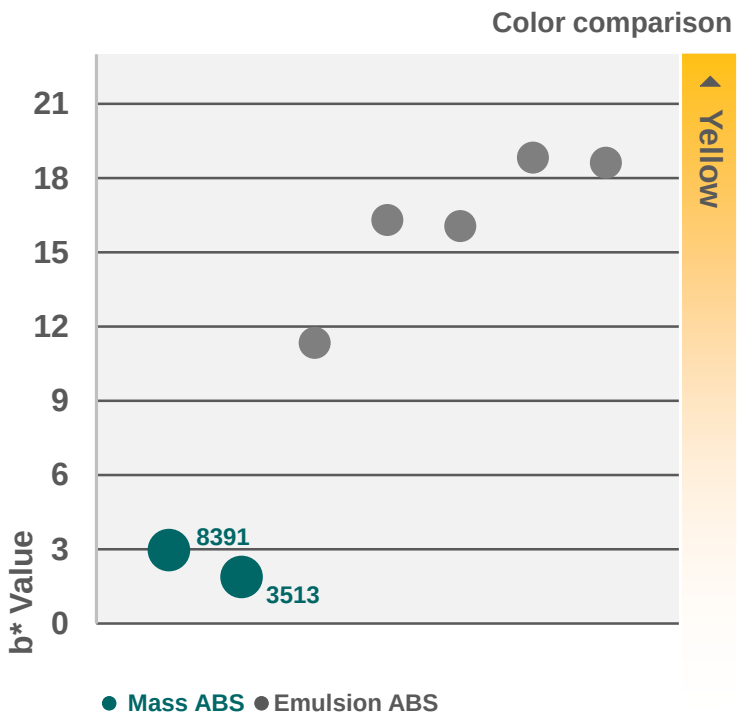


TRINSEO

White Base Color

White Base Color

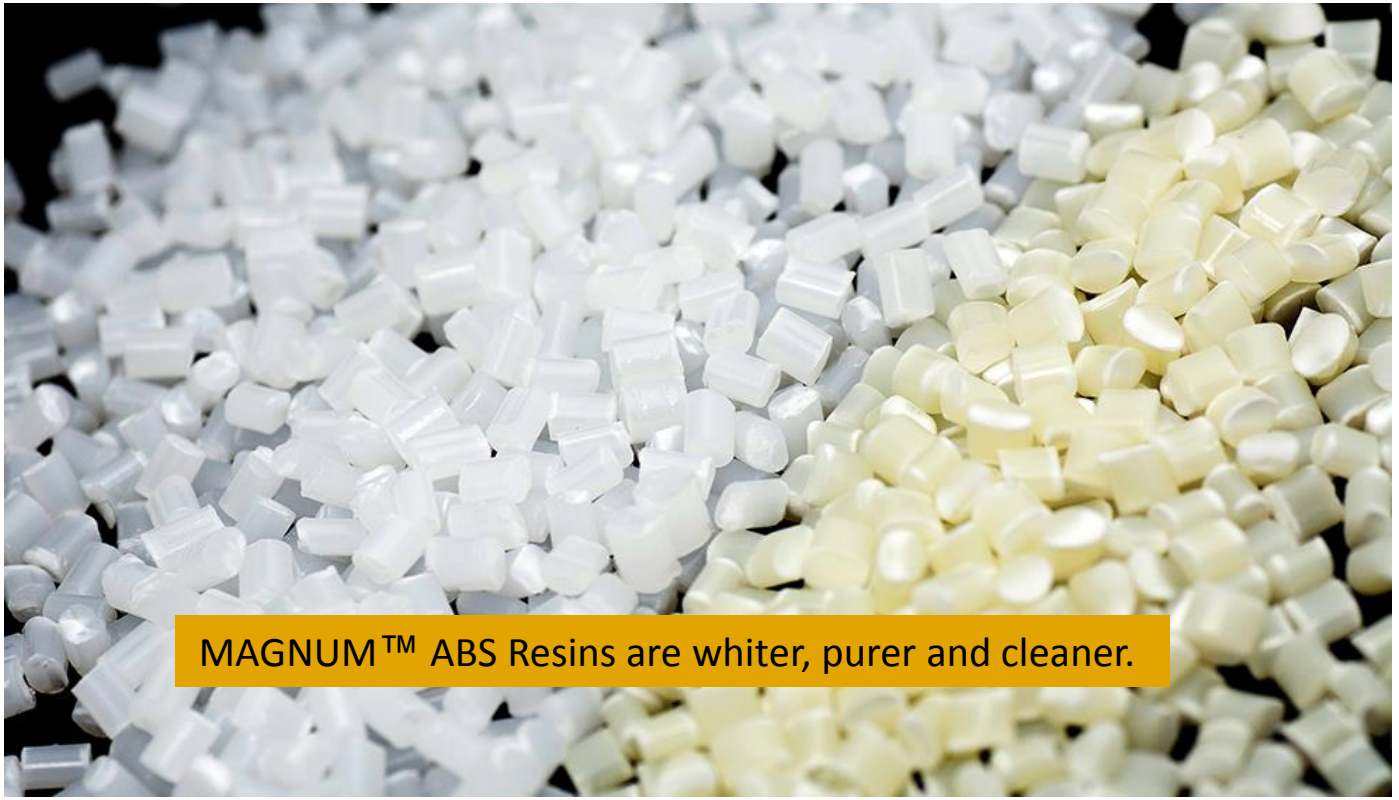
Compared with other ABS resins in the market, the base color of MAGNUM™ ABS Resins is significantly whiter.



TRINSEO™

Natural ABS Resin Color

Mass Polymerization



Emulsion Polymerization

TRINSEO™

Lot to lot consistency

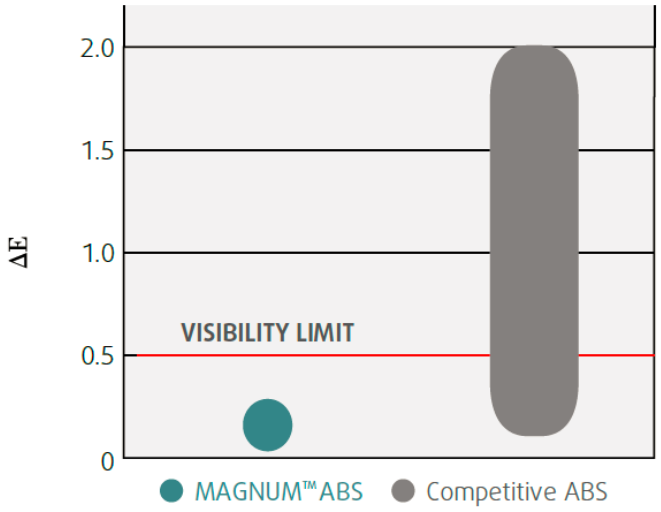
Lot-To-Lot Consistency

MAGNUM™ ABS Resins have higher consistency – lot-to-lot and run after run.

Typical Run Sizes

Trinseo Mass ABS (Continuous)	Emulsion ABS (Batch)
400-1200 MT	10-100 MT

Consistency comparison



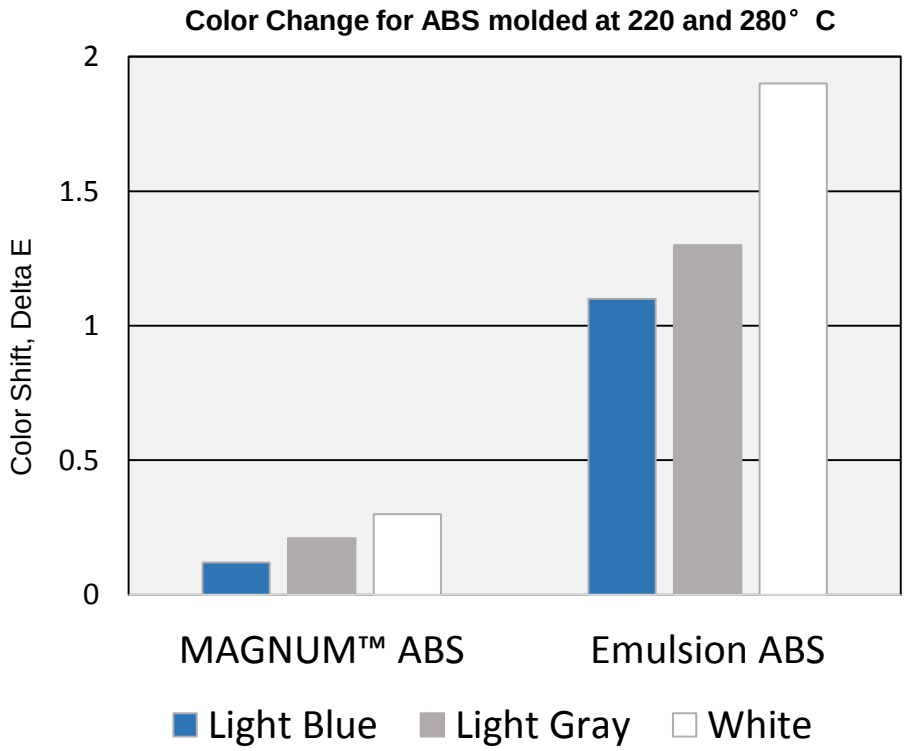
TRINSEO

Color Stable During Molding

Color Stable during Molding

MAGNUM™ ABS Resins offer improved color stability during molding.

Material has a broad processing window and color of molded parts will be consistent



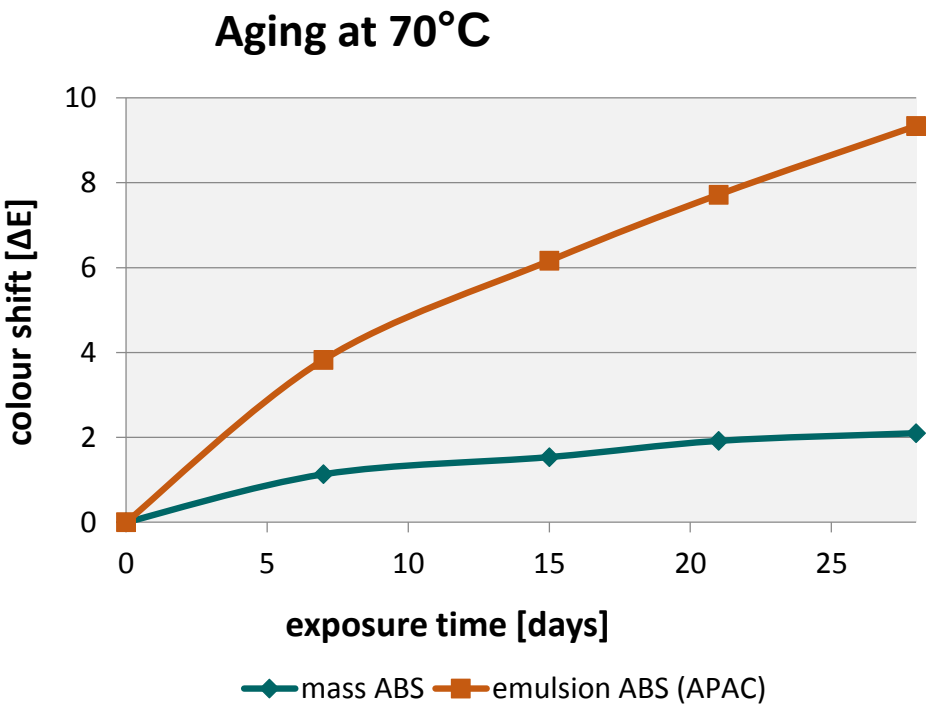
TRINSEO

Color Stable at Elevated Temperatures

Color Stable at Elevated Temperature

MAGNUM™ ABS Resins offer improved color stability during heat aging testing.

Material will be color stable over long periods of time and aging conditions.



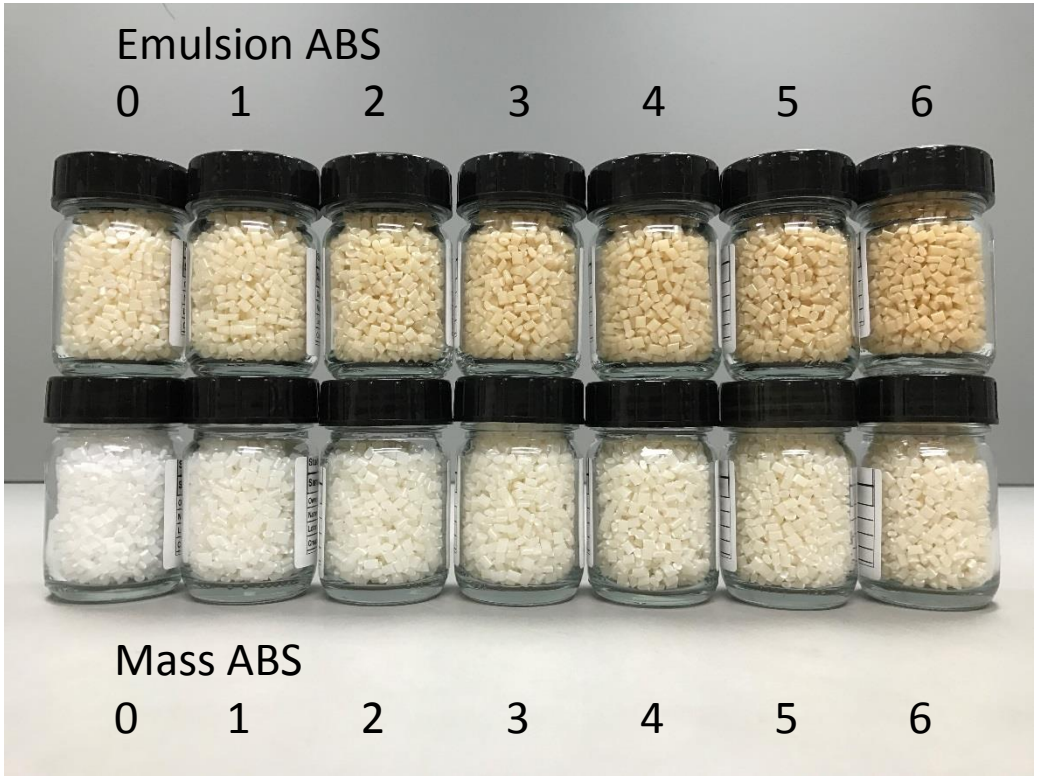
TRINSEO™

Thermal Stability

Color Stability with Processing

MAGNUM™ ABS Resins offer improved thermal stability during processing

Material will be color stable over multiple processing passes to allow regrind.



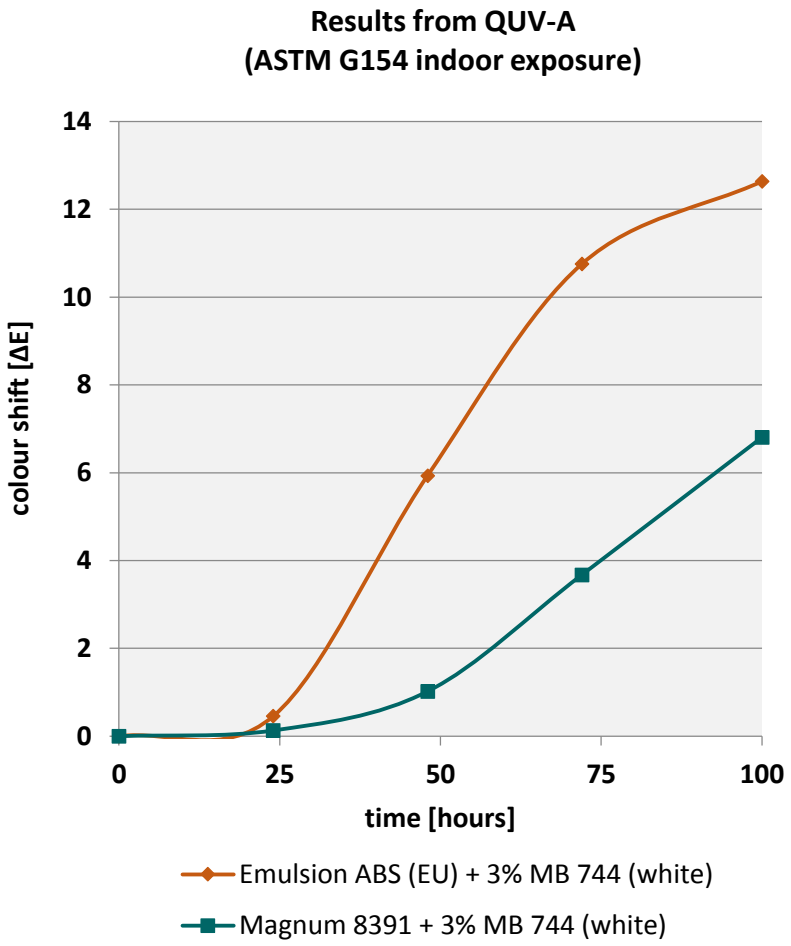
regrind passes

TRINSEO™

Color Stable after UV Exposure

Color Stable after UV Exposure

MAGNUM™ ABS Resins offer improved color stability after UV exposure

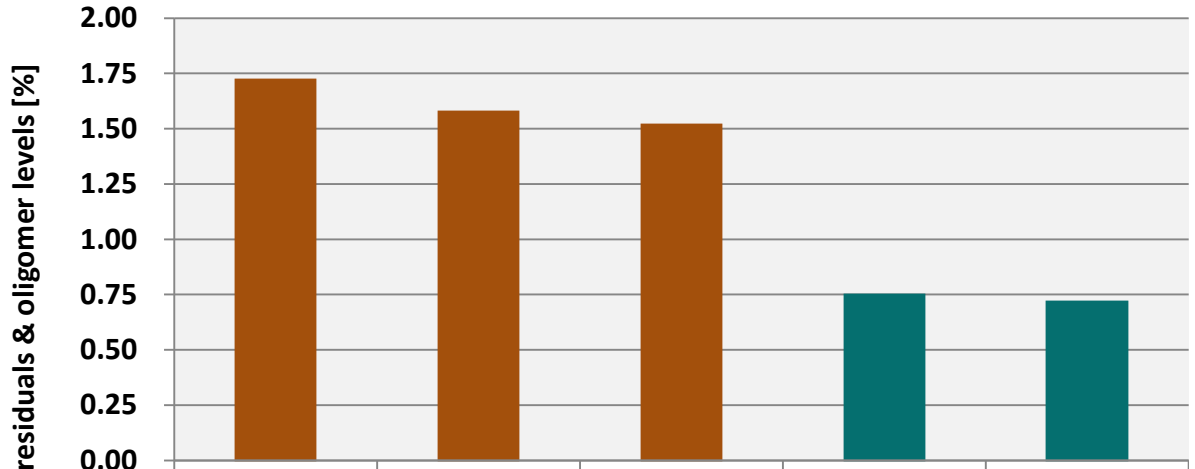


TRINSEO™

Residual Monomers and Oligomers

Low Residuals and Oligomers

MAGNUM™ ABS Resins offer lower residuals and oligomers for a more pure resin



	emulsion ABS (US), coloured	emulsion ABS (EU) Natural	emulsion ABS (EU) white	Magnum 8391 MED Natural	Magnum 8391 MED white
residual monomer & oligomer level	1.72	1.58	1.52	0.75	0.72

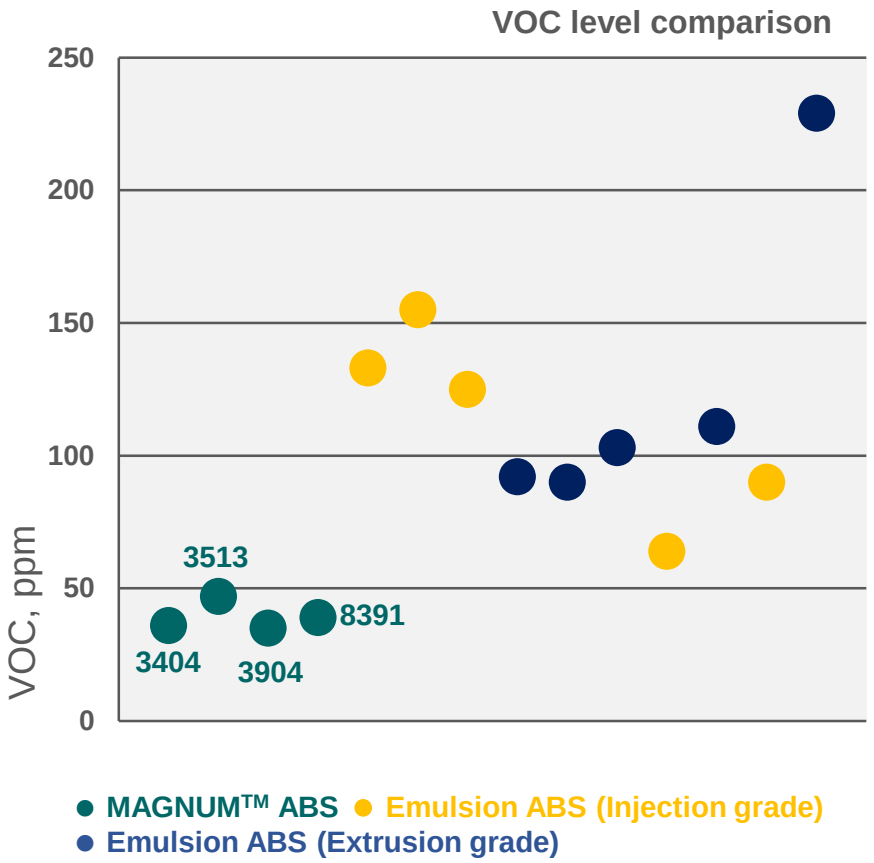
TRINSEO

Low Volatile Organic Compounds

Low VOC (Volatile Organic Compounds)

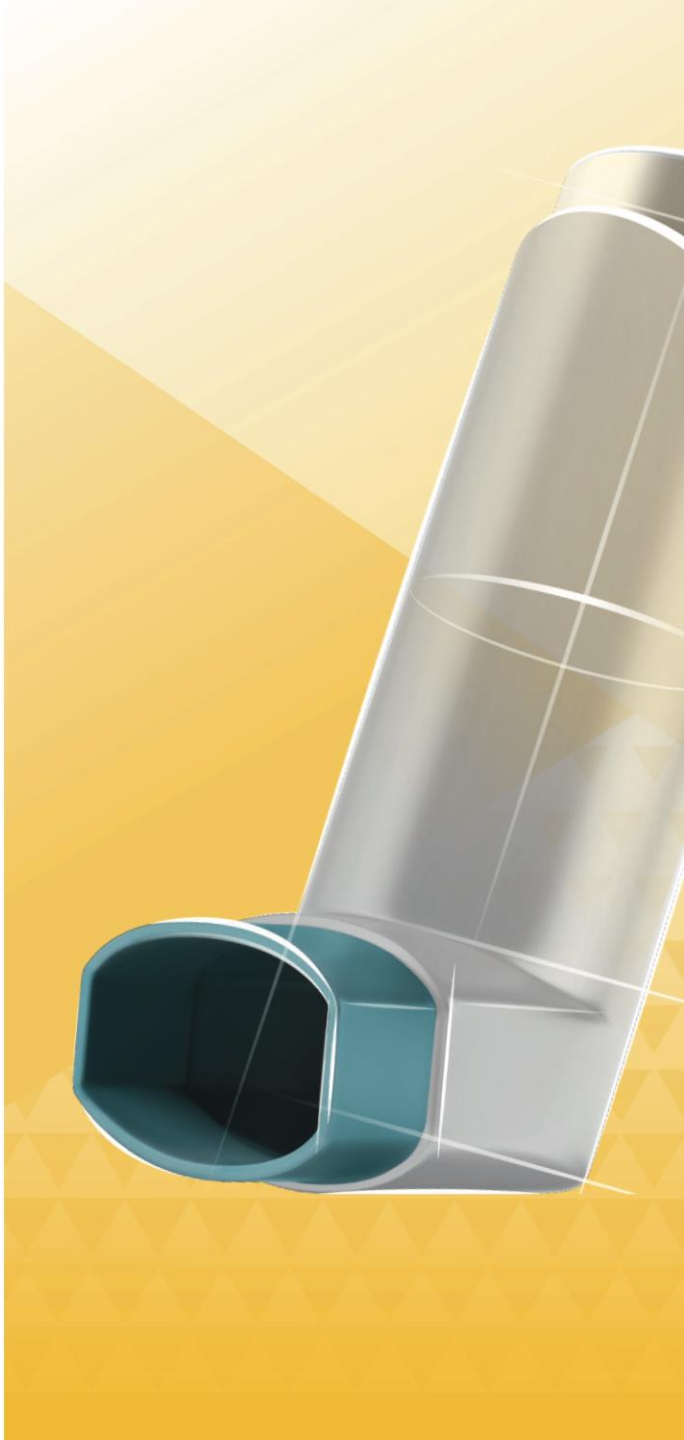
MAGNUM™ ABS Resins have significantly lower VOC levels.

Low VOC levels means less odor during the manufacturing process, as well as for the end products. This also helps meet government regulations.



TRINSEO™

Features	Benefits
Superior natural resin whiteness	• less pigment needed • less cost • true color
Excellent processability	• wide processing window • more parts per hour
Consistency in performance	• Improved molded part consistency • less down time
Low levels of process additives	• Low VOC and odor • Reduced surface plate-out on parts • Temperature and UV stability



TRINSEO

Trinseo MAGNUM™ ABS Resins for Non-Automotive Applications

Grade	Process	Features
MAGNUM™ 3404	Extrusion	• General purpose • Medium impact
MAGNUM™ 3904	Extrusion	• Ultra high impact
MAGNUM™ 3513	Injection molding / extrusion	• A balance of good flow and high impact
MAGNUM™ 8391	Injection	• Excellent gloss • Very good flow • Medium impact
MAGNUM™ 8391 MED	Injection	• Medical Grade Resin • ISO 10993

TRINSEO™

Medical Resin Offerings

TRINSEO

Questions?

A copy of this webinar will be sent to you and posted online.

Thank you for joining the call.

Contacts

North America & Europe

Paula Biskup

biskup@trinseo.com

Asia Pacific

Phyllis Fong

phyllisfong@trinseo.com

www.trinseo.com