




EASTMAN

*Redefining the balance
between processability
and chemical resistance
for medical devices.*

Copolyesters in Medical Devices
Scott Hanson

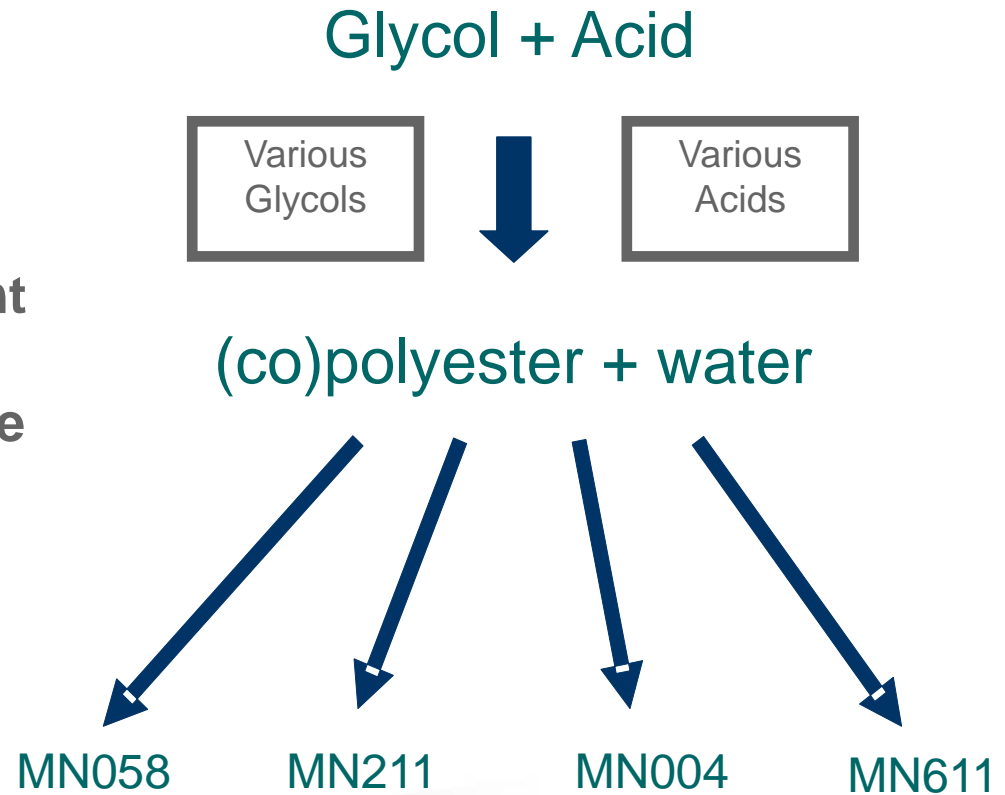
Topics

- Intro: Copolyesters 101
 - Why Copolyesters: Key Benefits and Applications
 - Health Care Industry Trends: Innovation Drivers
 - New Copolyester Breakthroughs
- 

Copolyester Chemistry 101

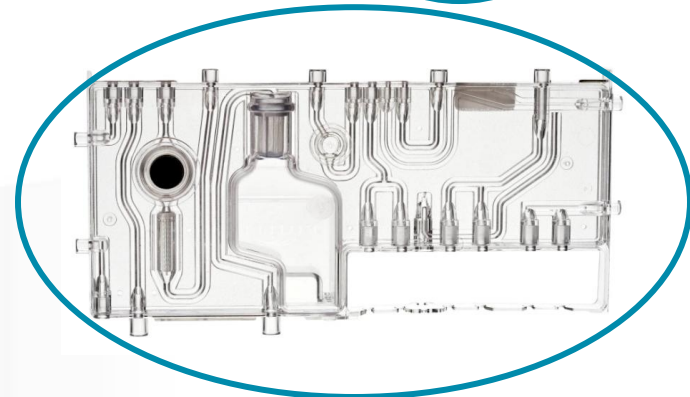
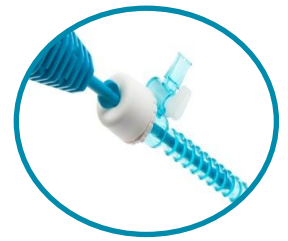
- Polyester = many esters
- PET Best known
- Copolyester = substitution of comonomers to engineer different properties:

- Glass Transition Temperature
- Flex Modulus
- Rate of Crystallization
- Toughness
- Density



Heritage Copolyesters for the Medical Industry: Key Benefits


- Outstanding clarity, minimal color shift
- Exceptional chemical resistance
- Halogen, Phthalate and BPA free
- Remarkably tough



Heritage Copolyesters for the Medical Industry: Historic Limitations

- Processing – easy, *if* guidelines understood and followed
- Moderate Tg - Temperature Resistance, Creep, Aging

Health Care Industry: Facing Challenging Issues

- Patient Safety, Comfort, Risk Management
 - Cost Containment
 - Sustainability
- 

Example:

Hospital Acquired Infections (HAI)

- ~ 6% hospitalized patients are infected with HAI in US
- Typically \$16,000- \$19,000 per infection
- Medicaid & Medicare shift responsibility of HAIs to hospital
 - “Medicare will no longer pay the additional cost of the hospitalization. The patient is not responsible for the additional cost. Rather the hospital is encouraged to prevent the adverse event and improve reliability of care.”
- Solutions being implemented/under consideration:
 - Swabbing, gloves, hand washing procedures, etc.
 - Aggressive disinfectants
 - Antibiotics
 - Antimicrobial materials

Translating Trends to Material Requirements...

Industry Challenge

- Patient Safety & Comfort
- Cost Containment
- Sustainability

Industry Need

- Less Infection
- Appearance
- Safe Packaging

- Less annealing
- Faster Cycle Time
- Thinner walls

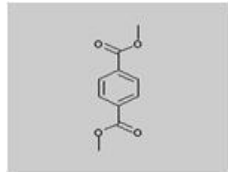
- Less Scrap

- BPA Free

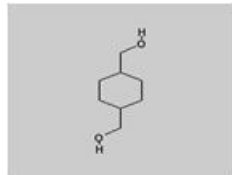
Material Science Solution

- Clarity
- Antimicrobial
- Chemical Resistance
- Residual Stress
- Black Specks
- Durability
- Toughness
- Regrindable
- Extensive Testing

New Generation Copolyesters: Eastman Tritan™ Copolyester



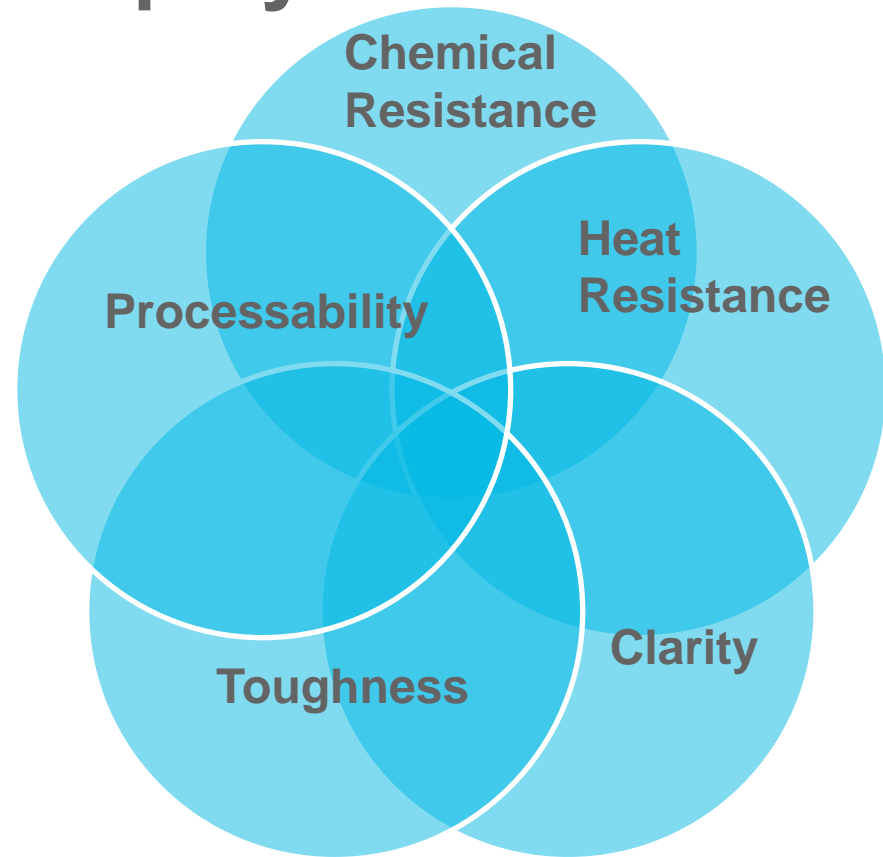
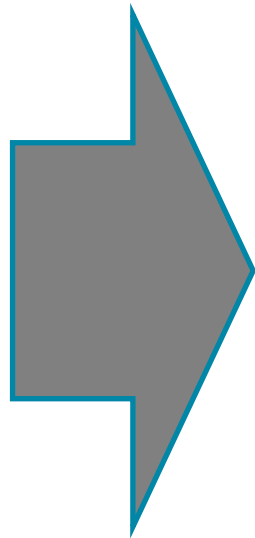
DMT



CHDM

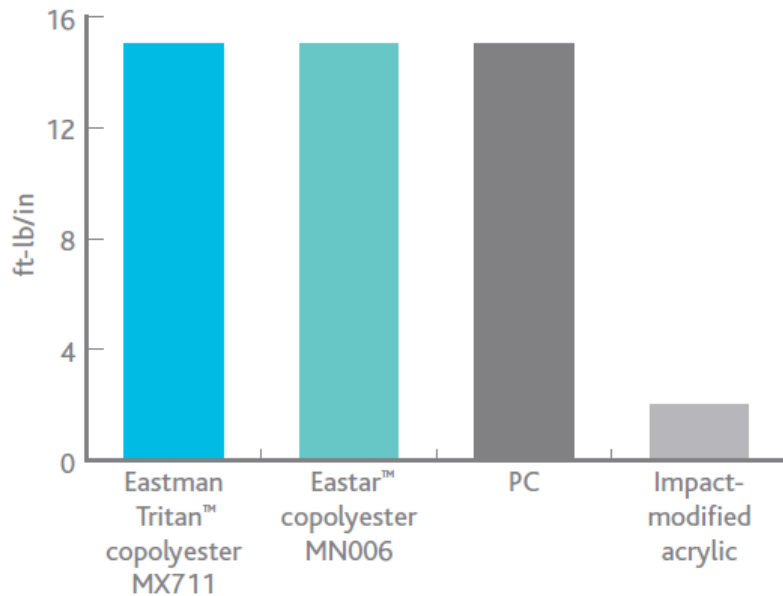


TMCD

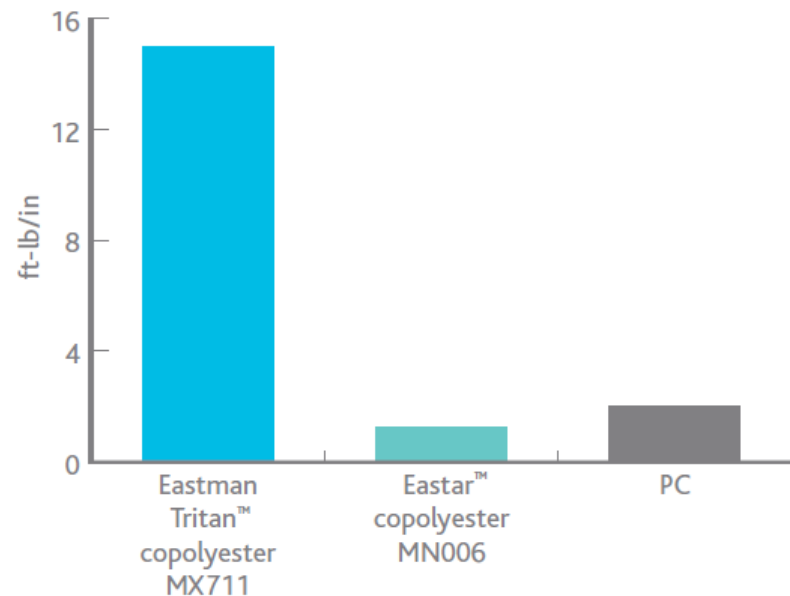


Health Care Challenge: Improved Toughness

Notched Izod 1/8"

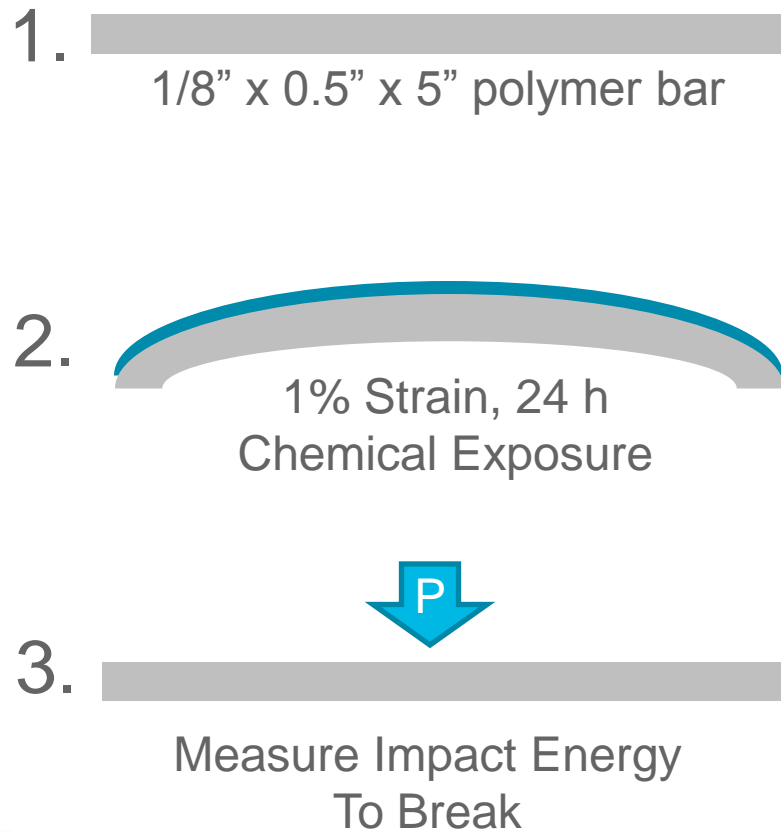


Notched Izod 1/4"



Health Care Challenge: Improved Chemical Resistance

code	% Retention
high	>66%
medium	66-33%
low	<33%
Plasticized	>100%



Sample	Control (Joules)	Lipids	IPA
		% Retention in Properties	
Tritan™ (Standard)	4.4	87%	79%
Tritan™ (High Flow)	4.3	90%	87%
Tritan (High Tg)	4.7	85%	32%
PC (High Flow)	5.3	53%	22%
PC (Standard)	5.4	92%	85%
Acrylic	0.8	61%	0%
Acrylic (IM)	3.2	77%	10%
Styrene-Acrylic	1.0	88%	61%
PP	2.8	93%	94%
Styrene-Butadiene	0.9	51%	31%
Styrene-Butadiene (IM)	3.2	21%	13%
SAN	1.0	89%	38%
TABS	3.3	49%	10%
PSU	5.8	89%	24%

Chemical Resistance

Visible Cracks in Real Molded PC Articles

PC Syringe – 24h IPA



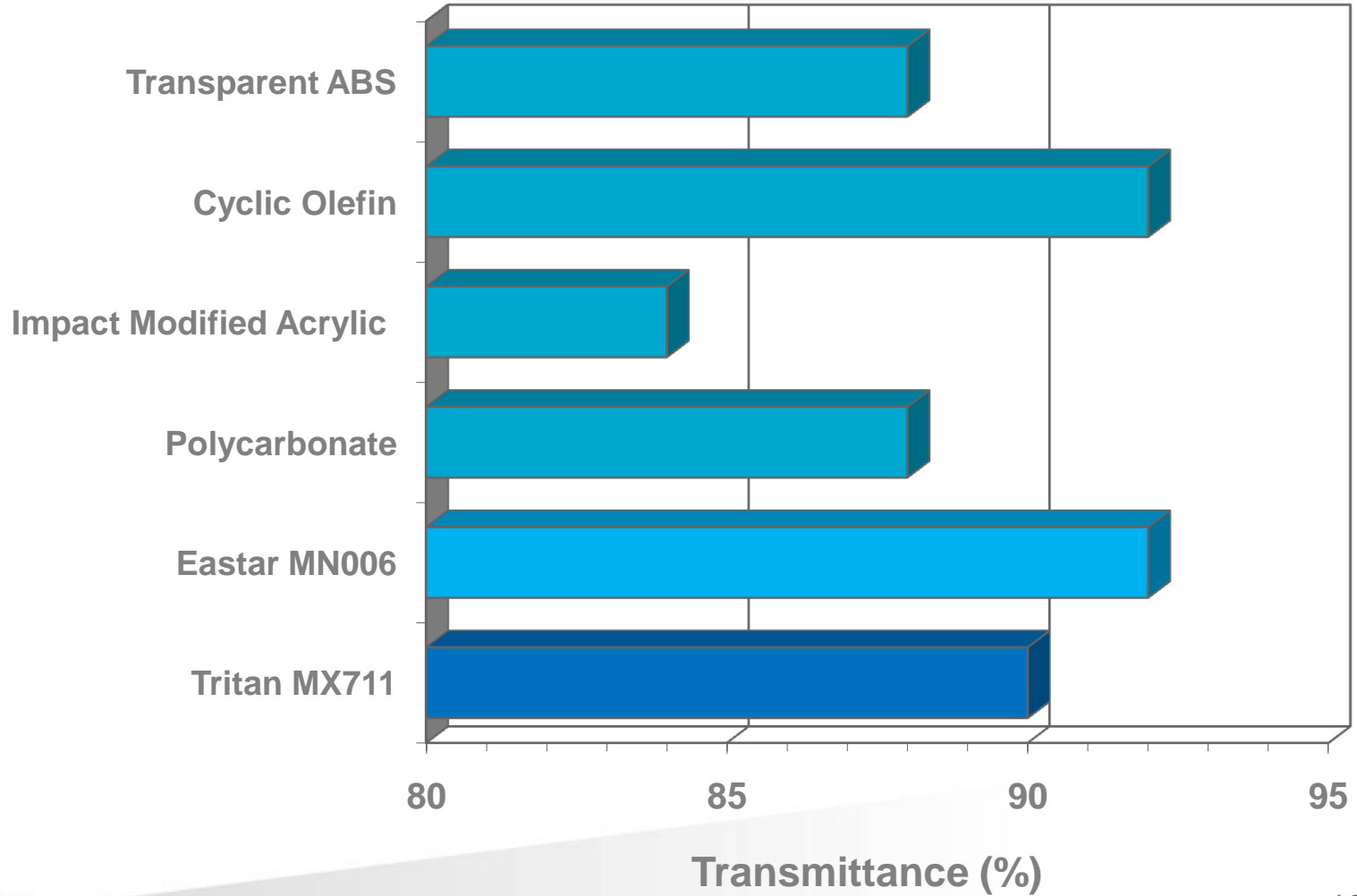
Dialyzer PC 8h Virex TB (left)



Dialyzer Tritan™ 120h Virex TB (right)

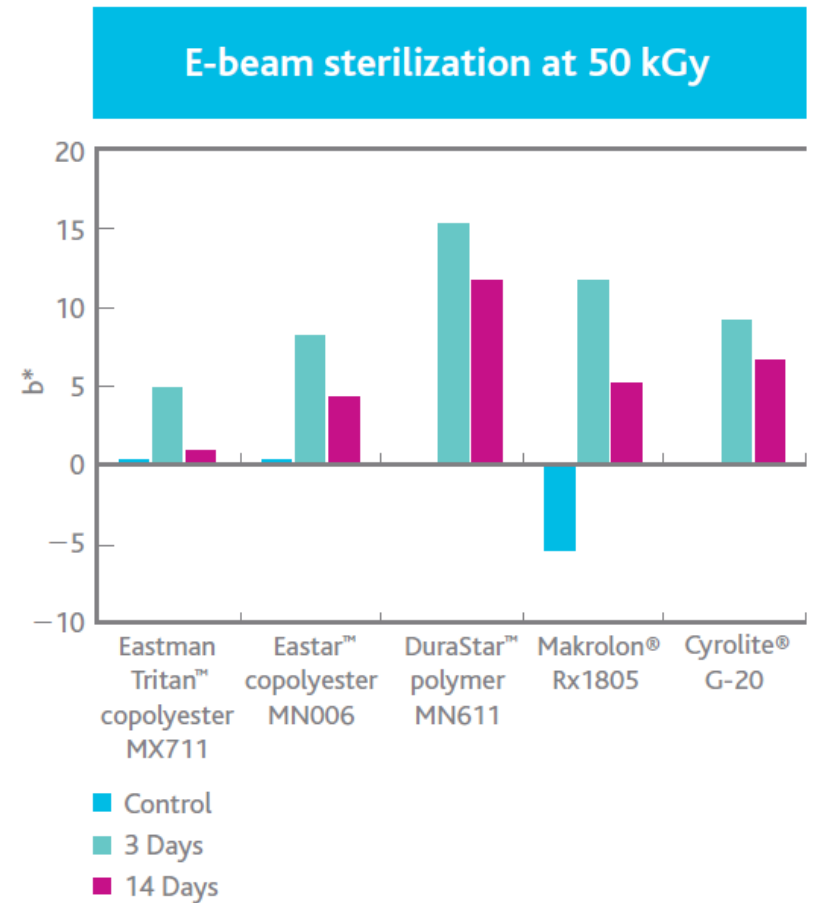
New Copolyesters have excellent toughness and chemical resistance to withstand aggressive disinfectants to reduce HAIs

Clarity

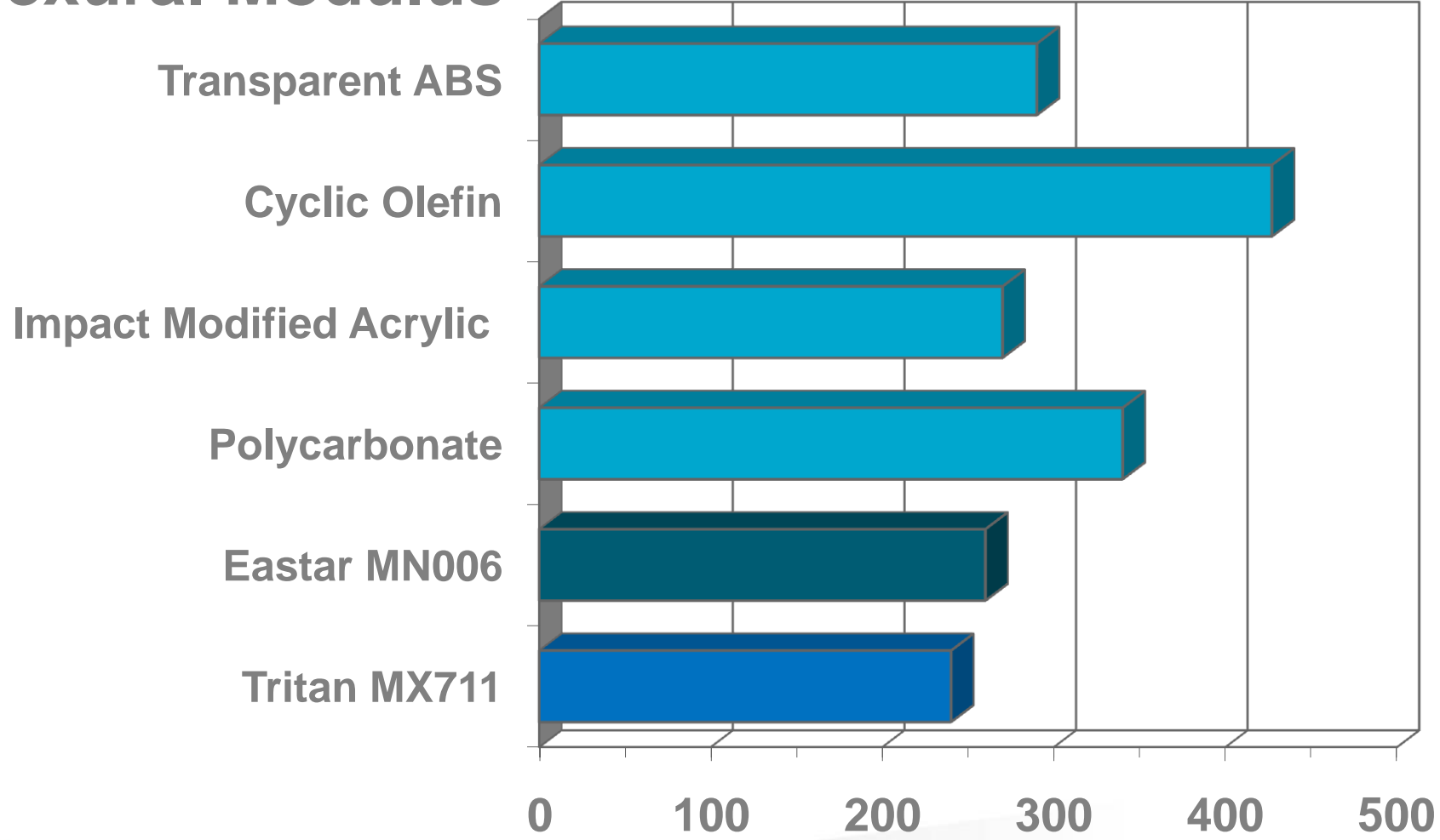


Color shift during sterilization

Less color shift – better aesthetics & patient comfort and product can be shipped much faster.



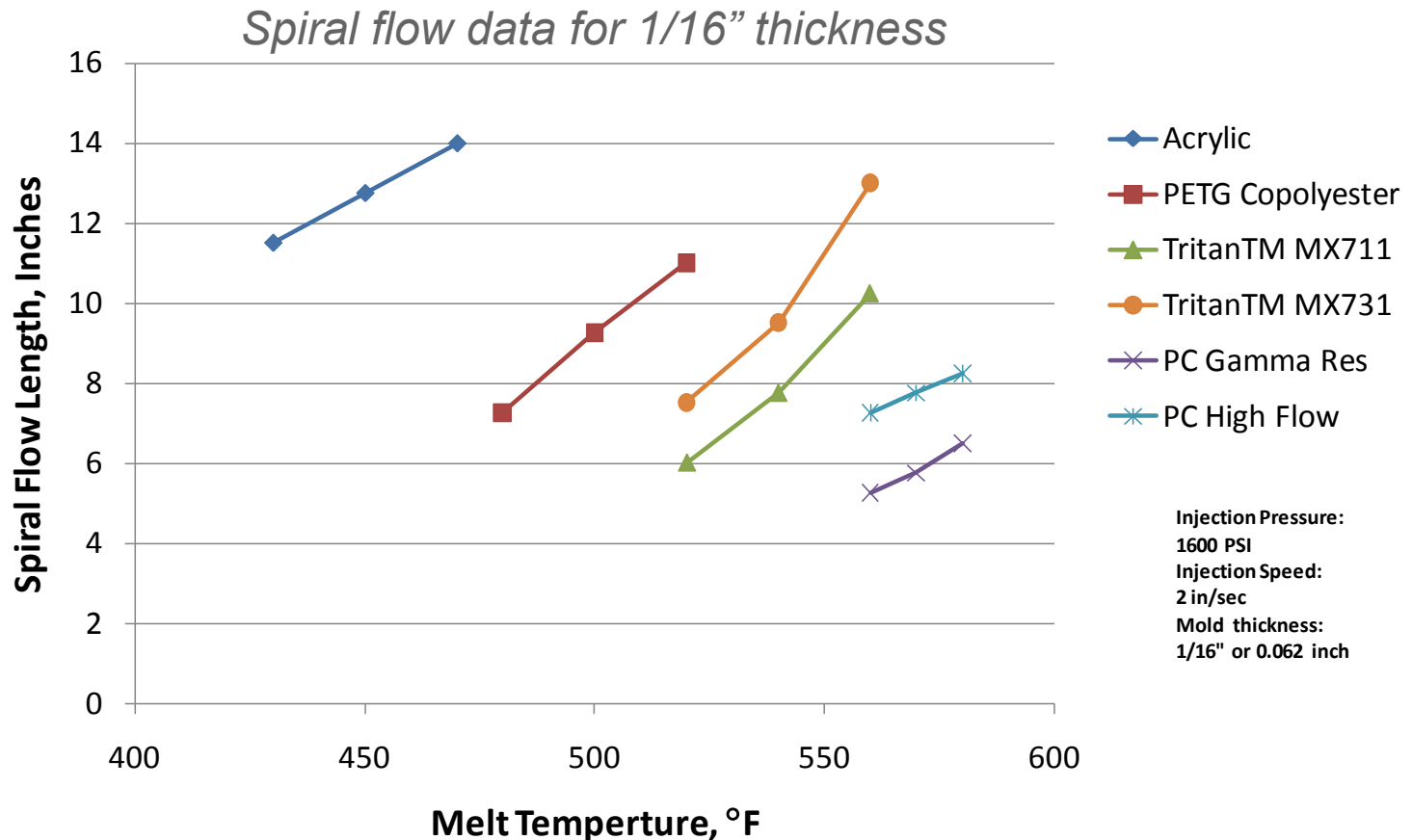
Flexural Modulus



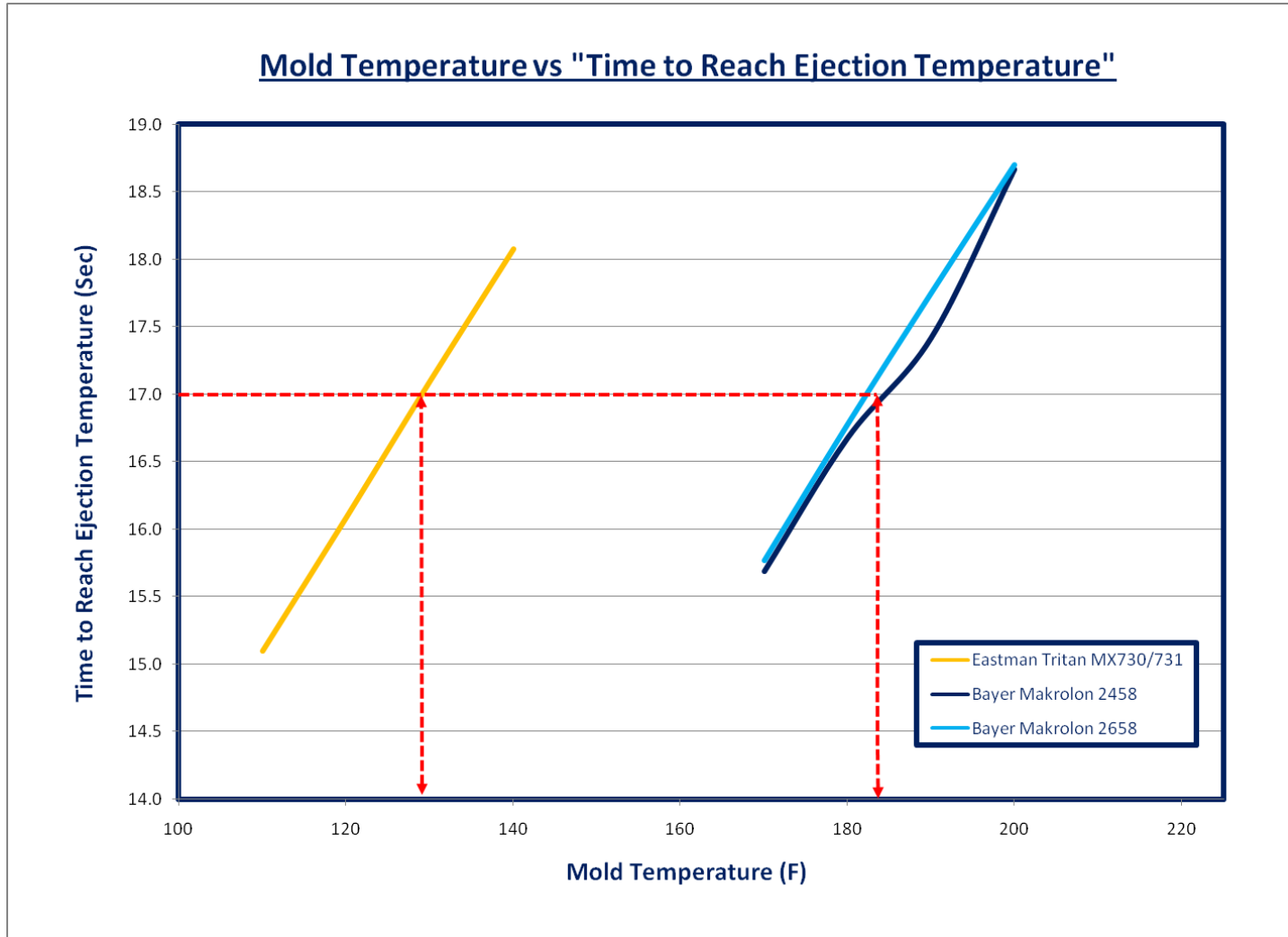
Flex Modulus (kpsi)

Flow Characteristics: Filling difficult to mold devices

Trend is smaller, thinner, portable, differentiated devices.



Cycle Time



Processability

Residual stress

- New Copolyesters have low residual stress.
- Lower residual stress improves chemical resistance.
- PC may require slow cooling or annealing.

Thermal Hydrolytic Stability Testing:



Un-annealed PC
(severe cracks)



Annealed PC
(No cracks)



Unannealed
Tritan™
(No cracks)

New Copolyester / ABS blends: Trilliant HC™

- Excellent Chemical Resistance
- Excellent toughness, durability
- High flowability
- Attractive aesthetics



Tritan™ / ABS blends: Trilliant HC™

Eastman and PolyOne

- Eastman and PolyOne have aligned to introduce commercial formulations of Tritan™ blends, filled and fully compounded colored products.
 - Initial grades of Tritan™ glass and mineral filled products were introduced in February '09.
- This cooperation will develop unique solutions to customer needs by blending Tritan™ with other thermoplastic materials.
- The initial product designations are Tritan™/ABS blends:
 - Edgetek XT 1000
 - Edgetek XT 1001
 - Trilliant HC grades medical – FDA compliance

PolyOne

EASTMAN

Where will Trilliant HC™ play?

- Trilliant HC™ is best positioned to compete with PC/ABS in UL-94 HB applications
- These devices are largely portable, battery-powered electronics
- Chemical resistance issues in housings

UL-94 HB



Copolyesters provide a balance of important advantages:

Chemical and Lipid Resistance-

Sterilization Flexibility-

Toughness -

Secondary operations and assembly flexibility-

Ability to use existing tooling and equipment with minimal modification -

**Unique Balance of Chemical Resistance, Toughness,
and Processability**



Eastman is a total solutions provider for the medical industry

- Supplier for more than 65 years
- Committed to long-term industry needs
- Reliable supplier of technical support for medical devices
- Resins for devices and packaging applications



EASTMAN
Delivering Performance
In Medical Devices and Packaging

Thank you!