

Helping shape **what's next** in medical devices and packaging.

Eastman medical polymers



When medical science meets polymer science. **To benefit you.**

The medical industry is continually pursuing ways to provide products that are safe, reliable, and easy to use. The marriage of application knowledge and material knowledge can advance this pursuit in many market-changing ways.

Eastman Chemical Company has been a worldwide supplier of a wide range of materials for the medical market for more than 70 years, while consistently raising standards for quality, patient safety, customer service, and sustainability.

Today, as always, Eastman is committed to the long-term needs of the medical industry and is a reliable provider of innovative medical grade polymers and technical support.

- Our "total-solutions" approach to the medical industry delivers outstanding technical support in design, processing, and secondary operations.
- Today's expanded portfolio of Eastman medical polymers makes Eastman better prepared than ever to help you shape what's next.



Eastman can meet your needs.

Eastman is well in tune with the latest industry regulations and works with customers and independent design firms to stay in step with—and often a step ahead of—our customers' application needs. As a result, Eastman resins are providing solutions and safer alternatives for a wide range of medical devices, health care products, and packaging applications, including:

- Nonimplantable medical devices
- Blood contact components
- Portable diagnostic equipment
- Heart/lung bypass system
- Needle-free injection system
- Infusion systems
- IV components
- Needleless access connector
- Tubing
- Opaque rigid medical packaging
- Thermoformed pharmaceutical packaging
- Medical kits
- Work-in-process trays
- Drug delivery devices, including syringes, insulin pens, and inhalers
- Minimally invasive surgical devices, such as cannulas and trocar systems
- Instruments
- Connectors, manifolds, luers, and catheters for fluid administration
- Fluid and respiratory canisters
- Health care supplies
- Labware
- Pharmaceutical packaging
- Rigid medical packaging
- Flexible packaging
- Single-use bioprocessing equipment

Additional information on the advantages of specific Eastman medical polymers, as well as how we can help bring your innovative products to market quickly and efficiently, is discussed on the following pages.

BPA-free materials to meet customers' needs for chemical resistance, toughness, sterilization, color stability, and performance, including:

Eastman Tritan™ copolyester

Eastar™ copolyesters

DuraStar™ polymers

Ecdel™ elastomers

Tenite™ cellulosics

Eastman Provista™ copolymer

Eastman Eastalite™ copolyester



When you collaborate to innovate.

Transforming an innovative concept into a successful, functional part that meets marketplace demands requires collaboration of many disciplines, including design engineers, material suppliers, equipment manufacturers (OEMs), and processors. Selecting the right material—and selecting it early in the development process—can be critical to the efficiency and long-term success of any go-to-market strategy.

A collaborative approach ensures all stakeholders share expertise, understand deadlines, and make decisions to help create durable, reliable medical devices that meet marketplace demand and increase patient safety and comfort.

The reusable Double Dosing Cup is a blueprint for success that can come from early collaboration with Eastman.

In addition to demonstrating a wide breadth of functional and processing possibilities for Eastman Tritan™ copolyester in the medical marketplace, the Double Dosing Cup is simply a lot of fun. The attractive and engaging prototype design, developed in collaboration with DD Studios, demonstrates the attributes of toughness, chemical resistance, vibrant clarity, and ability to be molded into intricate and complex forms. Male–female ellipses in the end cups demonstrate the remarkable cold-swaging capability of Tritan.

Sustainable innovation

Eastman strives to create solutions that offer more value with less environmental impact. Eastman medical polymers include environmentally responsible copolyesters and cellulose derivatives that are free of *ortho*-phthalate plasticizers, bisphenol A (BPA), and halogens. Many have been GREENGUARD Indoor Air Quality Certified®, and the outstanding toughness of these materials can facilitate designs that reduce weight and save energy.



Eastman brings more to the table.

Eastman brings industry-leading knowledge of copolyesters and other polymers, in addition to knowledge of molding, thermoforming, extrusion, processing, marketing, and design capabilities. We also understand the performance and regulatory demands of the marketplace. Eastman can help OEMs understand how our materials satisfy their needs through:

- Durability
- Chemical resistance
- Clarity
- Color stability
- Temperature resistance
- Faster cycle times with optimal molding conditions/design
- No annealing
- Improved processability over traditional copolyesters
- Secondary operations
- Reduced black specks and scrap rates



The following table shows some Eastman medical polymers that deliver these desired properties to your products. The following pages include information about how these polymers can help you produce high quality, functional, and aesthetically pleasing medical products.

Comparison of medical grade polymers

Material	Desired property					Comments
	Higher-heat resistance	Toughness	Lipid resistance	Solvent bonding	Faster injection molding cycles	
Eastman Tritan™ copolyester	●	●	●	●	●	Superior clarity after sterilization; BPA free; hydrolytic stability
Eastar™ copolyesters	●	●	●	●	●	Superior clarity after sterilization; BPA free
DuraStar™ polymers	●	●	●	●	●	BPA free
Ecdel™ elastomers	●	●	●	●	○	—
Tenite™ cellulose	●	●	●	●	●	BPA free
Eastman Provista™ copolymer	●	●	●	●	●	—
Polycarbonate	●	●	●	●	●	PC typically requires annealing at faster mold cycles to improve chemical resistance
Impact modified acrylic ^a	●	○	●	●	●	BPA free

● Best ● Good ● Average ● Fair ○ Poor

^aToughened acrylic represents general medical grade acrylic Cyrolite™ GS-90.

Eastman Tritan™ copolyester

Clear copolyester redefined.

Eastman Tritan™ copolyester is the latest in a long line of polymer solutions for the medical industry. Its unique combination of properties allows Tritan to satisfy a set of customer needs that previously have not been met by other polymers.

Like other Eastman medical polymers, this next-generation copolyester provides outstanding lipid and chemical resistance and Eastman Tritan™ copolyester is not manufactured with bisphenol A (BPA), *ortho*-phthalate plasticizers, or halogens.



In addition, Eastman Tritan™ copolyester offers greater toughness, heat resistance, and processability than other copolyesters. Tritan delivers outstanding performance for clear and opaque device or equipment applications and for rigid medical packaging. It is ideal for applications that demand:

- Long-term toughness/product protection
- Superior chemical resistance (including lipids, IPA, disinfecting agents, and bonding solvents)
- Excellent clarity
- Retention of clarity, color stability, and functional integrity following sterilization by
 - Gamma irradiation
 - Electron beam (e-beam) irradiation

Rigid medical packaging

- Extruded products deliver best-in-class toughness and excellent heat resistance.
- Allows more rapid accelerated-aging protocols and increased shelf life
- Excellent toughness provides an opportunity to redesign packaging to reduce thickness, thereby reducing source material, shipping weight, and energy use.

For more information about Eastman Tritan™ copolyester, visit www.eastman.com/tritan.

Explore a wide range of applications.

Devices and equipment

- IV-system components
- Blood contact devices
- Patient monitoring systems
- Infusion and feeding pumps
- Drug delivery systems and devices
- Blood glucose meters and insulin pens
- Pulse oximeters and spirometer housings
- Various clear and opaque parts for instruments and monitoring equipment
- Excellent toughness increases durability and reduces risk of part failure.
- Several medical grades available—including mold release and high flow—to fit processing requirements



Eastman Tritan™ copolyester MXF121

Well suited for the demands of daily use.

Eastman Tritan™ copolyester MXF121 is an opaque polymer that provides excellent chemical resistance with flame-retardant properties and is well suited for the demands of daily use. Tritan MXF121 also offers manufacturers the marketing advantages of precise brand palette expression and the opportunity to provide devices made without BPA.

Key advantages

- Flame-retardant properties—UL 94 V2 rating @ 1.5 and 3.0 mm thickness
- Chemical resistance—greater chemical compatibility than PC and PC/ABS blends
- High level of toughness—high impact resistance and excellent durability
- Meets hospital Environmentally Preferable Purchasing (EPP) guidelines—made without bisphenol A (BPA), halogens, or *ortho*-phthalate plasticizers
- Reliable color matching—drawing on the expertise of the Eastman Color Technology Center

Chemical resistance that is compatible with today's health care environments

Tritan MXF121 offers excellent chemical compatibility with aggressive disinfectants used to combat hospital-acquired infections (HAIs). These chemicals can cause cracking or crazing in devices made of polycarbonate (PC) or polycarbonate/acrylonitrile butadiene styrene (PC/ABS) blends—compromising device aesthetics and performance and potentially leading to product failure.

Toughness that is compatible with repeated handling

The high toughness and impact resistance of Tritan MXF121 can improve durability and reduce product failure. Parts molded with Tritan MXF121 do not require annealing to relieve residual stress—delivering the optimum balance of processability and performance.

Compatible with branding and sustainability initiatives

Many brand owners who use opaque polymers want precise color matching and vibrant aesthetics for their brand identity. Eastman Tritan™ copolyester MXF121 provides the assurances of working with the Eastman Color Technology Center—a leader in color theory and application since 1934. Tritan MXF121 also can enhance a brand image by supporting market preferences for BPA-free devices.





Eastar™ copolyesters

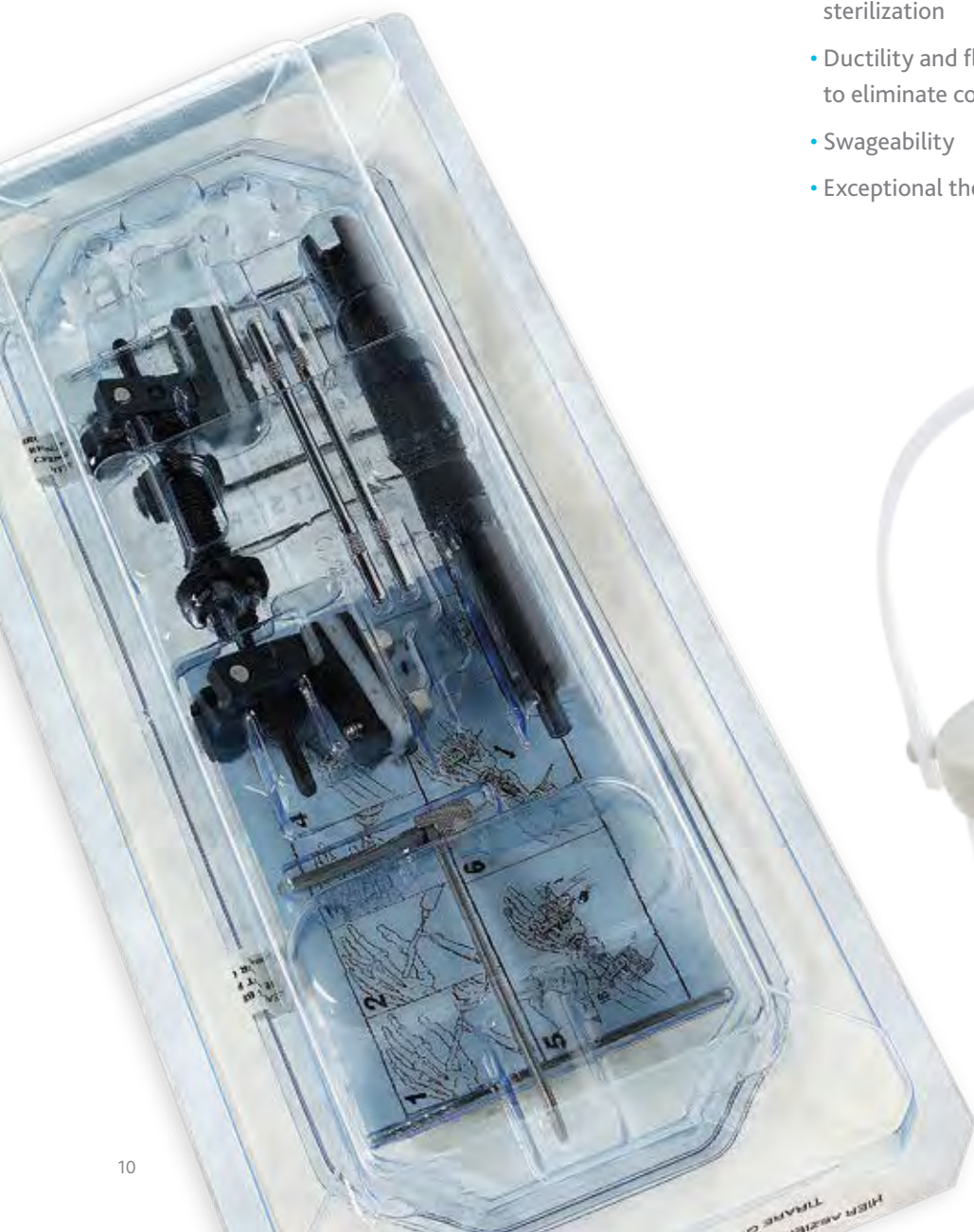
Your confidence earned.

Eastar™ copolyesters have a long tradition as the materials of choice in the medical industry. Eastman offers a wide range of grades of Eastar to match various biological/regulatory, sterilization, and disposal requirements.

Eastar copolyesters are made without BPA, *ortho*-phthalates, or halogens; Eastar MN004 and MN006 are GREENGUARD Indoor Air Quality Certified®.

The outstanding balance of properties provided by Eastar copolyesters includes:

- Exceptional toughness to withstand stress and impact
- Good chemical resistance to withstand attack from a variety of medical solutions, including IPA and lipids
- Superb clarity and high gloss
- Excellent colorability
- Exceptional color stability after gamma and e-beam sterilization
- Ductility and flexibility, allowing snap-fit assembly to eliminate costly solvent bonding
- Swageability
- Exceptional thermoformability and sealability



Explore a wide range of applications.

Devices

- Fluid administration
- Blood contact devices and connectors
- Syringe components
- Pump housings
- Drug delivery
- Surgical instruments
- Clamps
- Dialysis components
- Suction and drainage
- Labware
- Several medical grades available—including mold release and high flow—to fit processing requirements

Rigid medical packaging

- Eastar™ copolyester 6763 has been the material of choice for rigid medical packaging for more than 20 years.
- Eastar is easy to extrude, cut, print, and seal.
- Stiffness and strength improve the ability to downgauge materials and increase printing speed.

For more information about Eastar™ copolyesters, visit www.eastman.com/eastar.



Eastman Eastalite™ copolyester

Opportunity is at the core.

Eastman Eastalite™ copolyester is the core layer between surfaces of proven and trusted Eastar™ copolyester 6763. Each surface of Eastar 6763 ensures excellent and consistent seal integrity as well as several processing and performance advantages:

- It can be cut with minimal generation of particulates and angel hair—further ensuring the seal won't be compromised by contamination.
- It can be processed with the same thermoforming, sealing, and extrusion equipment as Eastar 6763 or HIPS.
- It is ideal for a variety of medical applications, including:
 - Rigid medical packaging for medical devices
 - Thermoformed pharmaceutical packaging
 - Medical kits
 - Work-in-process trays
 - Mounting cards



Opportunities at every level

The unique combination of properties of Eastman Eastalite™ copolyester offers opportunities in opaque rigid medical packaging in a variety of ways.

Opportunities for design flexibility

- Allows deep undercuts that are not practical with HIPS
- Provides flex resistance and durability
- Makes processing easier and faster
- Allows easy printability

Opportunities for cost savings

- Eastalite is competitive with HIPS on a surface area (MSI) basis, but overall process cost may be lower because it can:
 - Reduce the need to sharpen trim blades
 - Reduce material waste resulting from the brittleness of HIPS
 - Reduce waste related to black specks with HIPS
 - Reduce the need for cleaning particulates
 - Reduce the need for inspection
 - Be thermoformed at a lower temperature that can decrease cycle time

Opportunities for sustainable innovation

- Market opaque products that satisfy a growing need for safe, sustainable, and lightweight rigid medical packaging
- Advance market share by offering products that satisfy more stringent Environmentally Preferable Purchasing (EPP) guidelines

For more information about Eastman Eastalite™ copolyester, visit www.eastman.com/eastalite.



More Eastman medical polymers

Your polymer solutions advanced.

In addition to Eastman Tritan™ copolyester and Eastar™ copolyesters, Eastman offers a variety of resins for selected performance needs and applications.

DuraStar™ polymers

In addition to the environmental advantages of other Eastman medical polymers, DuraStar™ polymers have the right mix of properties and processability for injection molding, including:

- Sparkling clarity and gloss
- Excellent toughness
- Easy to process and fabricate—dries quickly and flows well
- Excellent chemical resistance
- Good barrier properties

Eastman Provista™ copolymer

Eastman Provista™ copolymer offers a special balance of processing and performance characteristics that make this copolymer well-suited for a wide range of profile configurations and applications. Provista provides excellent toughness, clarity, and gloss in addition to easy processing. It is GREENGUARD Indoor Air Quality Certified®.

Tenite™ cellulotics

In addition to industry-leading chemical resistance, Tenite™ cellulotics provide sparkling clarity and outstanding toughness and color stability following gamma, ethylene oxide (EtO), and e-beam sterilization. Tenite is ideal for devices requiring higher flow like IV components, medical tubing, and surgical instruments.

In keeping with the Eastman tradition of environmental consciousness, Tenite™ cellulotics are made from 100% renewable softwood.

Ecdel™ elastomers

When extruded into film or sheet, Ecdel™ elastomers combine the chemical resistance, toughness, and inertness of polyesters over a broad temperature range. Ecdel elastomers are copolyester ethers (COPE) that remain remarkably clear and free of blush or haze during high-temperature use in applications such as:

- Intravenous therapy packaging
- Pharmaceutical packaging
- Flexible device packaging
- Bioprocessing equipment

In addition to toughness, clarity, and flexibility without plasticizers, Ecdel is autoclavable and provides outstanding heat sealability and long-term integrity.

Why wait to collaborate?

Involving Eastman early in the process can help avoid false starts and limit manufacturing disruptions. Our technical services expertise can help ensure manufacturability and proper tooling, processing, testing, and secondary operations. Eastman enjoys the trust of some of the industry's foremost innovators. And we have experience working with customers throughout the value chain who are developing medical devices and packaging on the cutting edge of polymer science.

For more information about Eastman medical polymers or how Eastman can help you find the best solutions to deliver performance and peace of mind, visit www.eastman.com/medical or call 1-800-Eastman (1-800-327-8626, ext. 5408).





The results of insight™

**Eastman Chemical Company
Corporate Headquarters**

P.O. Box 431
Kingsport, TN 37662-5280 U.S.A.

U.S.A. and Canada, 800-EASTMAN (800-327-8626)
Other Locations, +(1) 423-229-2000

www.eastman.com/locations

Safety Data Sheets providing safety precautions that should be observed when handling and storing Eastman products are available online or by request. You should obtain and review the available material safety information before handling any of these products. If any materials mentioned are not Eastman products, appropriate industrial hygiene and other safety precautions recommended by their manufacturers should be observed.

It is the responsibility of the medical device manufacturer ("Manufacturer") to determine the suitability of all component parts and raw materials, including any Eastman product, used in its final product to ensure safety and compliance with requirements of the United States Food and Drug Administration (FDA) or other international regulatory agencies.

Eastman products have not been designed for nor are they promoted for end uses that would be categorized either by the United States FDA or by the International Standards Organization (ISO) as implant devices. Eastman products are not intended for use in the following applications: (1) in any bodily implant applications for greater than 30 days, based on FDA-Modified ISO-10993, Part 1, "Biological Evaluation of Medical Devices" tests (including any cosmetic, reconstructive, or reproductive implant applications); (2) in any cardiac prosthetic device application, regardless of the length of time involved, including, without limitation, pacemaker leads and devices, artificial hearts, heart valves, intra-aortic balloons and control systems, and ventricular bypass assisted devices; or (3) as any critical component in any medical device that supports or sustains human life.

For manufacturers of medical devices, biological evaluation of medical devices is performed to determine the potential toxicity resulting from contact of the component materials of the device with the body. The ranges of tests under FDA-Modified ISO-10993, Part 1, "Biological Evaluation of Medical Devices" include cytotoxicity, sensitization, irritation or intracutaneous reactivity, systemic toxicity (acute), subchronic toxicity (subacute), implantation, and hemocompatibility. For Eastman products offered for the medical market, limited testing information is available on request. The Manufacturer of the medical device is responsible for the biological evaluation of the finished medical device.

The suitability of an Eastman product in a given end-use environment is dependent on various conditions including, without limitation, chemical compatibility, temperature, part design, sterilization method, residual stresses, and external loads. It is the responsibility of the Manufacturer to evaluate its final product under actual end-use requirements and to adequately advise and warn purchasers and users thereof.

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