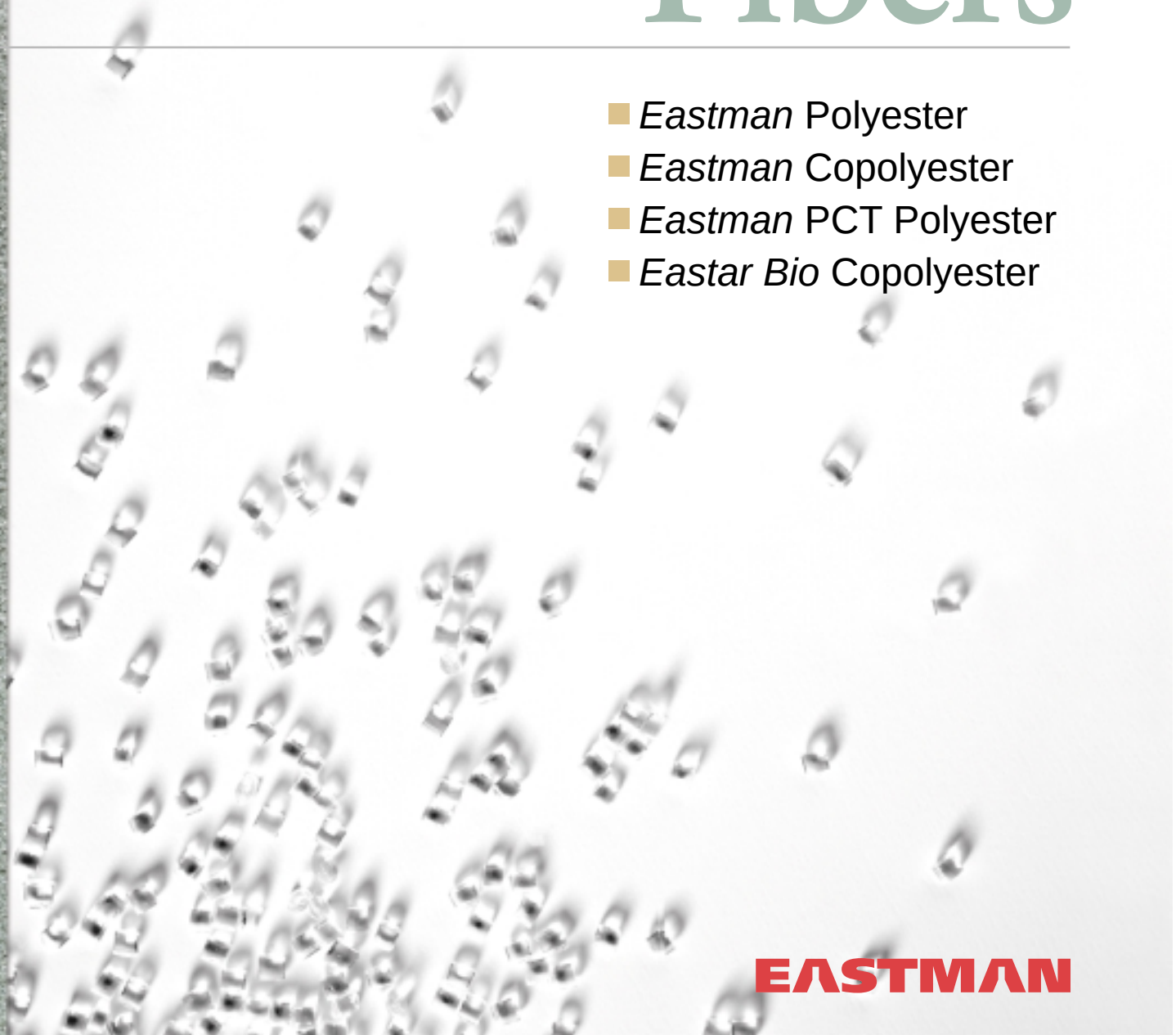
Eastman Polymers for Fibers

- *Eastman* Polyester
- *Eastman* Copolyester
- *Eastman* PCT Polyester
- *Eastar Bio* Copolyester



EASTMAN

Eastman Chemical Company and the Fibers Industry

As a key supplier of polyesters to the fibers industry for many years, Eastman Chemical Company has accumulated an extensive wealth of knowledge and expertise in polymer chemistry and technology. Because Eastman now supplies only resin and not fiber itself, we are able to share our comprehensive fiber knowledge and polymer competency with our customers. Eastman's years of experience in manufacturing copolyester resins enable us to assist fiber manufacturers in enhancing their products and better serving their customers.

Commitment

Key to describing Eastman and its relationship to customers in the fibers industry is its commitment to:

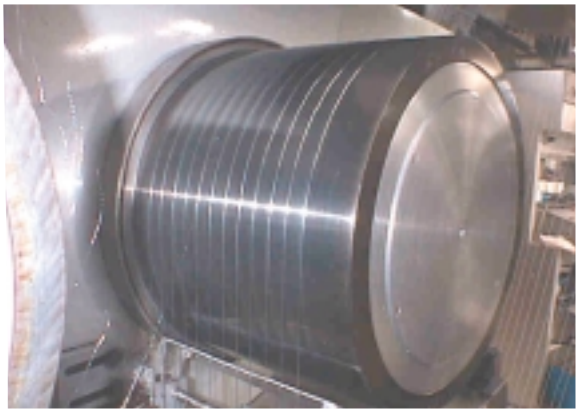
Quality—Eastman's commitment to quality has been recognized both nationally and internationally. The recipient of numerous quality awards, Eastman became the first and only major chemical or plastic manufacturer to receive the prestigious Malcolm Baldrige National Quality Award in 1993. Our quality systems for polymers are also ISO 9002 registered.

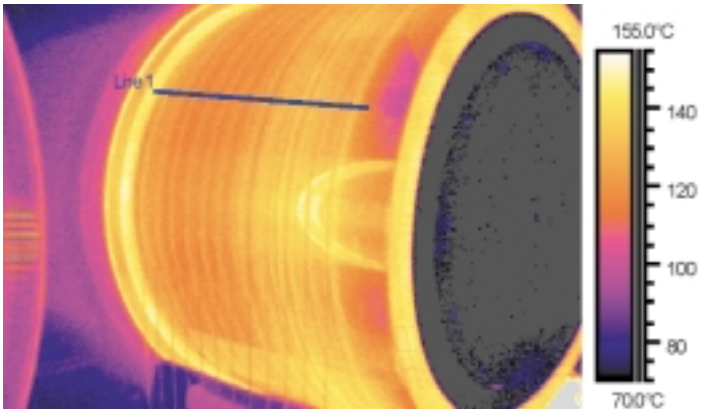
Value-added supplier—As the world's largest producer of polyester pellets, Eastman has proven itself as a reliable, long-term supplier of polymers to the fibers industry. With manufacturing sites located around the world, Eastman works closely with customers to ensure that we maximize the value we add to their systems. This includes everything from providing technical support and expertise to offering e-commerce capabilities that enhance and/or remove costs from the customer's business processes.

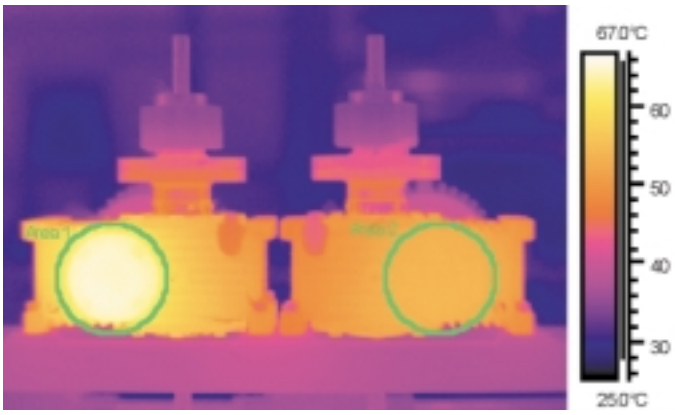
New product development—One way Eastman adds value for customers is through the development of new products and applications that meet their needs. From concentrates and additives to innovative new polyesters, our portfolio of products for the fibers industry is constantly growing.

Fiber Technology and Technical Support

Eastman can provide valuable technical assistance in producing fibers made from polymer pellets. Support includes polymer drying and spinning expertise, fiber and nonwoven pilot facilities, and diagnostic testing.







Infrared Thermography (an example of diagnostic testing offered by Eastman)

Broad Portfolio of Products

Eastman has four families of polymers that meet the needs of a wide range of applications for the fibers industry.

Eastman **polyester—**The PET (polyethylene terephthalate) family of polyesters includes both homopolymers and copolymers. *Eastman* PET pellets are available in a range of intrinsic viscosities (It.V.) from 0.53 to 0.95, making PET the material of choice for a variety of applications—from spunbonded and meltblown products to high-tenacity strapping.

Eastman **copolyester—**This unique family of glycol-modified polyethylene terephthalates was developed for binder fiber and deep dyeable applications. Products range in inherent viscosity (Ih.V.) from 0.47 to 0.70. *Eastman* copolyester can be used in both unicomponent and bicomponent binder fibers.

Eastman **PCT polyester—**The family of *Eastman* PCT [poly (cyclohexylene-dimethylene-terephthalate)] polyester has superior physical and chemical attributes, making it the choice for fabrics that must perform well in demanding high-temperature applications and environments, as well as those calling for superior softness combined with resilience. It is used to produce staple fibers, filament yarns, and spunbonded and meltblown fabrics.

Eastar Bio **copolyester—**The unique chemistry of this patented product family yields fibers and spunbonded and meltblown fabrics with a wide range of utility that are completely biodegradable.

Eastman Polyesters

Eastman has been in the PET polyester business for more than 30 years and has a reputation as a trustworthy, dependable supplier of high-quality polyester pellets. We maintain in-house expertise in fibers spinning and associated processes (drying, extrusion, etc.). And, since we no longer compete in the fibers industry (Eastman exited the fibers business in 1993), we are willing to share that expertise with our customers.

Homopolymers

Basic *Eastman* PET polyesters are homopolymers. They range in It.V. from 0.53 to 0.95. Eastman's general-purpose homopolymers have an It.V. of 0.61. This polyester is available in both amorphous and crystallized pellets and is used to produce both unicomponent and bicomponent staple fiber, and spunbonded and meltblown fibers.

Eastman's higher-viscosity homopolymer PET (0.72–0.80 It.V.) is used to produce shaped fibers that are frequently used in apparel and filtration. These higher It.V. products are typically available in crystalline form.

Eastman PET homopolymer with the highest viscosity (0.95 It.V.) is used for strapping and other very high-tenacity applications.

Copolymers

At Eastman, fiber-grade resins are designated as copolymers when they have been modified with low levels of CHDM, IPA, or other diols or diacids. These modifiers reduce the rate of crystallization and may act as spinning aids in high-speed spinning operations. Copolymers are available as both amorphous and crystallized pellets. Lower It.V. versions may be used for meltblown applications, while higher It.V. copolymers may be used in bulked continuous filament applications such as carpet.

Eastman Copolyesters

Eastman copolyesters for binder fiber and deep dyeable applications are based on Eastman's unique chemistry. They range in inherent viscosity from 0.47 to 0.70. Unicomponent binder fibers made of *Eastman* copolyester form clear bonds which, when bonded to colored fibers, retain the brightness of the colored fibers. Unicomponent fibers lose their fiber form when activated and produce softer, more drapeable structures than bicomponent fibers. Unicomponent fibers made of *Eastman* copolyester can be used to form meltblown adhesive webs. Because these webs aren't tacky, they can be meltblown and taken up without interleaving paper.

Eastman copolyesters are also suitable for use in bicomponent binder structures. They may be used as the sheath in a sheath/core configuration or side by side in combination with another polymer.

As the binder fiber component in textile yarns, flat nonwovens, high-loft battings, needlepunched fabrics, hydroentangled fabrics, stitch-bonded fabrics, wet-laid fabrics or paper, and fiberglass composites, *Eastman* copolyesters increase strength and lower the degree of linting, pilling, and fuzzing. In addition, they produce clear bonds that are transparent in combination with colored fibers.

Applications include facing and backing fabrics, comforters, robes, winter wear, rugs, medical and absorbent products, technical fabrics, geotextiles, filter media, and facemasks, as well as "prepregs" and structural preforms.

Easy Bonding/Easy Activation

Eastman copolyesters bond easily to a variety of materials including polyester, acrylic, nylon, cotton, fiberglass, cellulosics, and scoured wood.

Eastman copolyesters for binder can be easily activated using thermal energy. The lower Ih.V., higher-flow products were developed to facilitate the use of short-bonding ovens or faster throughput speeds. Activation can also be accomplished using radio frequency, dielectric, or ultrasonic processes.

Characteristics

The lower-level viscosity *Eastman* copolyesters are sold as amorphous pellets. One of the newest copolyesters for binder fibers has an inherent viscosity of 0.47, the lowest ever produced for a commercial copolyester pellet. The resulting higher-flow characteristic allows fiber extrusion at lower temperatures and/or pressures similar to those used for polypropylene.

For amorphous products, drying temperatures must be kept below 70°C (158°F). While moisture levels are not as critical as for PET, consistency less than 500 ppm and preferably less than 150 ppm is necessary for uniform performance.

Increasing temperatures in the melt result in decreasing melt viscosities. For CHDM copolyesters, increasing the CHDM content initially depresses, then eliminates, then increases the melting point (T_m).

Eastman PCT Polyesters

Eastman PCT polyester has an inherent viscosity of 0.77 and is used to produce staple fibers, filament yarns, and spunbonded and melt-blown fabrics. Fibers produced from *Eastman* PCT polyester have unique properties specifically designed for a wide range of specialty applications. Fibers made from this polyester are suitable for almost all textiles and nonwoven processes including carding, air- and wet-laid web forming, needlepunching, hydroentangling, bonding with binder fibers, and laminating.

Characteristics

Fabrics made from *Eastman* PCT polyester have high hydrolytic stability and low shrinkage. They can tolerate hot, moist environments, making them an ideal choice for products that must withstand repeated autoclaving or similar conditions and long-term use. In addition, they have high-thermal stability with a melting point of 290°C (555°F). As a result, PCT-based fabrics are used in industrial applications such as filtration and thermal and sound insulation.

Eastman PCT polyester is less dense than conventional polyester. Fibers made from PCT have a specific gravity of only 1.23, which means greater bulk in applications such as pile fabrics, comforters, bed pads, and carpeting.

Fiber made from *Eastman* PCT results in fabrics with more resilience than those made from conventional polyesters. *Eastman* PCT-based fibers have a higher melt and crimp-setting temperature, which results in crimp permanence, longer lasting bulk, excellent recovery from compression, and resistance to pilling, crushing, and matting of adjacent fibers. This attribute translates into pillows and fleece that are more comfortable and paint rollers that take up and release paint easily.

Because of their molecular composition, fabrics made of *Eastman* PCT polyester have an unusually soft hand. In addition, they can readily accept and retain dyes but are more stain resistant than nylons.

Eastman Polymers for Fibers

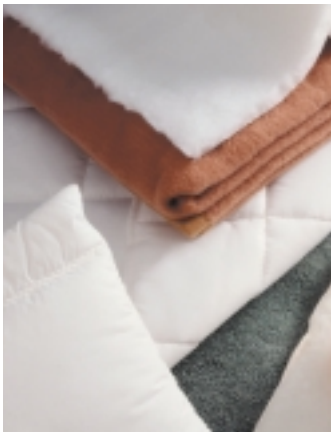
Eastar Bio Copolyesters

This family of resins performs for the useful life of the product and then biodegrades under the right conditions, leaving no environmental footprint. These resins are tough and resilient, liquid impermeable, and completely biodegradable.

Eastar Bio copolyesters can be meltspun into fibers as well as spunbonded and meltblown fabrics. Staple fibers, for example, can be blended with other compostable/biodegradable fibers for use in wipes, hygienic absorbent, medical/surgical, and other disposable or limited use products. Binder fibers made from *Eastar Bio* copolyesters form strong bonds with a wide range of polyesters and cellulosics. In bonded structures, these binder fibers also exhibit some elasticity that enables them to maintain unusually good bond integrity when subjected to repeated flexing. Bicomponent binder fibers incorporating *Eastar Bio* copolyester can be used unblended, as the total fiber content in the fabric. Various fibrous forms also offer utility in agricultural and horticultural applications, such as seed mats, erosion, and seasonal weed-control ground covers. There are a growing number of new and, in some cases, nontraditional fiber and fabric applications.

Solutions for the Fibers Industry

Innovative products, technical support, experience, and quality—these are the criteria for a polymer supplier to the fibers industry. Eastman knows fiber and is able to share its in-depth knowledge with fiber manufacturers because we concentrate on supplying you with resin. Eastman also provides manufacturers with inventive solutions to their fiber polymer needs.



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Publication MBF-226
February 2001

ECP 10418 Printed in U.S.A.