

A market-leading portfolio

The safety and biocompatibility you need.
The performance and supply security you demand.

Resomer®

For implantable
medical devices



RESOMER® portfolio of functional biomaterials

The leading brand with an unparalleled safety and biocompatibility record

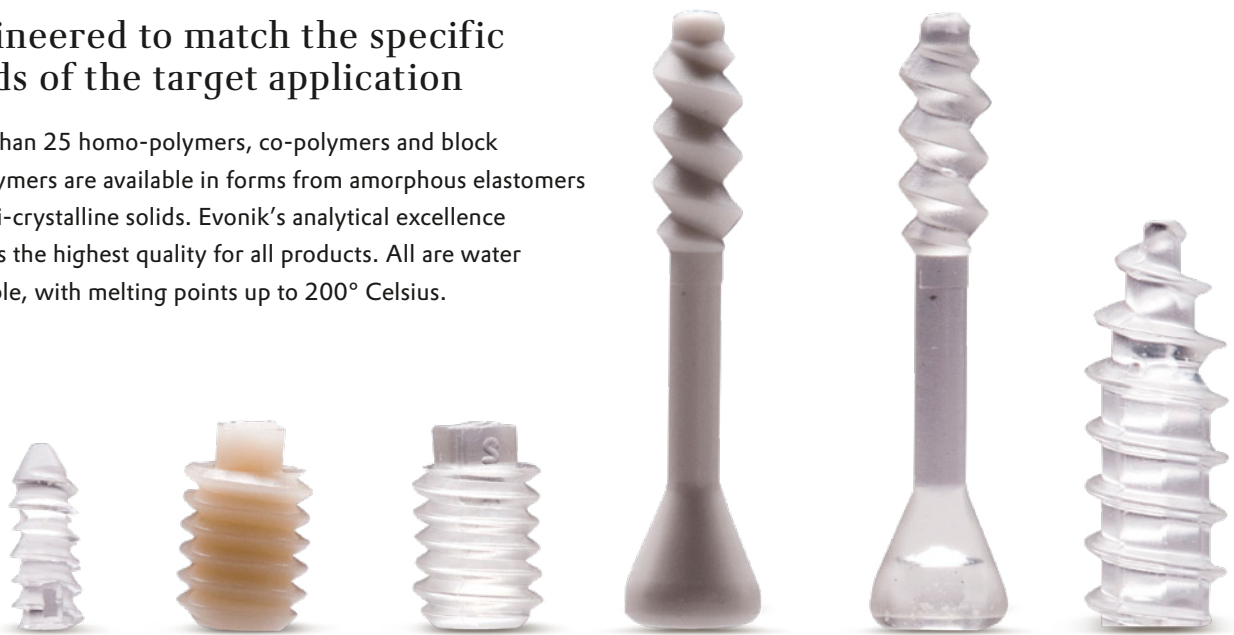
RESOMER® brings together the essential polymer characteristics and versatility in mechanical and chemical properties that companies require to optimize the biocompatibility and functionality of implantable devices.

All catalog and custom polymers are 100 % bioresorbable and completely metabolized by the body. With established safety profiles, they have a track record for commercial use across multiple application areas that exceeds 30 years.

- A wide range of degradation profiles from less than one month to more than four years
- Ability to obtain highly versatile mechanical properties to match specific application requirements
- Simple to process with standard extrusion, injection molding, medical textile, 3D printing and electrospinning technologies
- Compatible with common sterilization techniques
- Average shelf life of five years

Engineered to match the specific needs of the target application

More than 25 homo-polymers, co-polymers and block co-polymers are available in forms from amorphous elastomers to semi-crystalline solids. Evonik's analytical excellence ensures the highest quality for all products. All are water insoluble, with melting points up to 200° Celsius.



The portfolio's breadth and flexibility ensures key requirements of the following applications are met:

ORTHOPEDIC APPLICATIONS

(e.g., interference screws)

- Insertion torque
- Bone ingrowth
- Osteo-conductivity
- Minimum inflammation

CARDIOVASCULAR APPLICATIONS

(e.g., biodegradable stents)

- Radial strength
- Ductility
- Scaffold thickness
- Thrombosis and restenosis reduction

WOUND HEALING APPLICATIONS

(e.g., sutures, clips)

- Fast degradation
- Strength and durability
- Flexibility
- Dimension stability

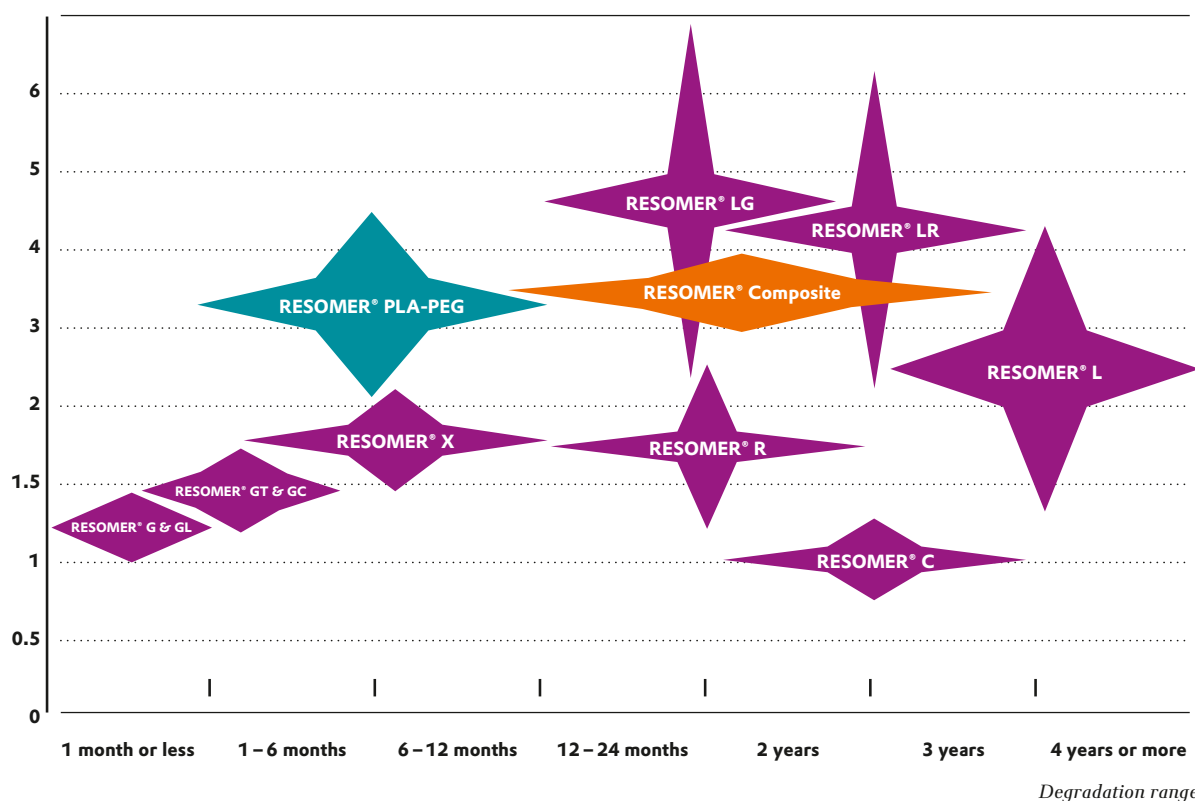
OTHER APPLICATIONS

(e.g., mesh, scaffolds)

- Burst strength
- Cell adhesion and proliferation
- Flexibility
- Frictionless gliding

A broad range of degradation times and molecular weights

IV [dL/g]



COMPOSITION	BRAND CLASS	CRYSTALLINITY	DEGRADATION	IV [dL/g]
Poly(L-lactide)	RESOMER® L	Semi-crystalline	>48 months	0.8 – 4.3
Poly(L-lactide-co-D,L-lactide)	RESOMER® LR	Amorphous	24–36 months	2.0 – 6.5
Poly(L-lactide) with calcium phosphates additives	RESOMER® Composite	Semi-crystalline	24–36 months	3.0 – 4.0
Poly(caprolactone)	RESOMER® C	Semi-crystalline	>24 months	0.8–1.38
Poly(L-lactide-co-glycolide)	RESOMER® LG	Amorphous	12–24 months	2.5–7.0
Poly(D,L-lactide)	RESOMER® R	Amorphous	12–24 months	1.3–1.7
PEG with Poly(L-lactide) or Poly(L-lactide-co-D, L-lactide)	RESOMER® PLA-PEG	Variable	<12 months	1.5–4.8
Polydioxanone	RESOMER® X	Semi-crystalline	<6 months	1.5–2.2
Poly(glycolide-co-caprolactone)	RESOMER® GC	Semi-crystalline	<6 months	1.15–1.55
Poly(glycolide-co-trimethylene carbonate)	RESOMER® GT	Semi-crystalline	<6 months	1.00–1.40
Poly(glycolide)	RESOMER® G	Semi-crystalline	<3 months	1.05–1.25
Poly(glycolide-co-L-lactide)	RESOMER® GL	Semi-crystalline	<3 months	1.05–1.25
Poly(L-lactide-co-trimethylene carbonate)	RESOMER® LT	N.A	N.A	1.2 – 1.6

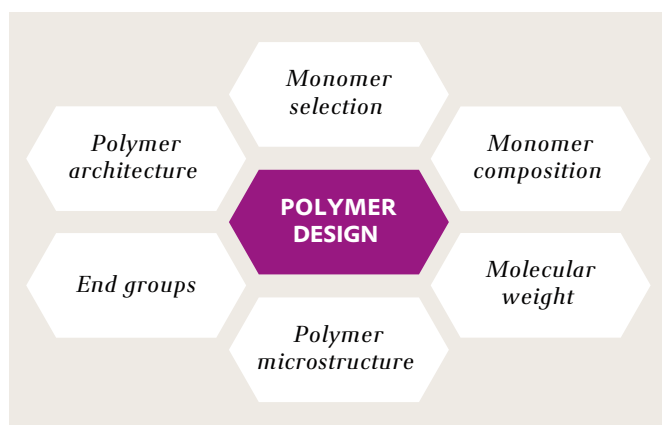
RESOMER® Select

The world's leading brand of custom-made polymers to match your specific application requirements

RESOMER® Select has been the world's leading brand of custom-made functional polymers since its inception more than a decade ago. The platform provides medical device companies with the flexibility to develop customized polymers that match their specific property requirements.

RESOMER® Select enables the custom synthesis of any polymer outside our standard range including RESOMER® Composite and RESOMER® PLA-PEG copolymers. Beyond the modification of common monomers and their respective ratios, Evonik can also provide tailored solutions including polymer architecture and end groups.

Products can be made to order at either of our U.S. or EU manufacturing sites, and are available in a range of batch sizes for clinical or commercial use.



RESOMER® Composite

Enhance bone fixation devices with robust osteoconductive and mechanical properties

RESOMER® Composite is a line of composite materials designed for use with bone fixation devices including interference screws, suture anchors and fracture plates.

The osteoconductive properties of calcium phosphate-based additives are combined with polymers providing precise degradation rate profiles and mechanical properties including elastic modulus to match the natural bone. This combination can help to minimize stress shielding to encourage faster bone healing with reduced inflammation.

All product grades are easy to process and supplied as ready-to-use pellets with uniform additive distribution. They are also radiolucent to avoid potential interference with X-ray equipment.



We offer the following standard range of composite materials:

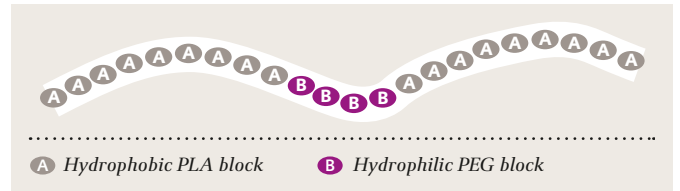
- RESOMER® Composite L 210 S + 25 % HA
- RESOMER® Composite LR 706 S + 30 % β -TCP
- RESOMER® Composite LG 855 S + 30 % β -TCP

RESOMER® PLA-PEG copolymers

The mechanical strength of standard polymers with degradation rates up to six times faster

This unique line of bioresorbable tri-block copolymers combines the hydrophobic properties of polylactide (PLA) with the hydrophilic properties of polyethylene glycol (PEG). Designed to enable wound closure, pediatric and other devices to better match the natural healing process, each grade provides the mechanical strength of its equivalent standard PLA polymer but yields degradation times up to six times faster.

Four L-lactide and L-lactide-co-D,L-lactide grades are included within the standard line with degradation rates from less than six months up to 12 months. All are easy to process with common manufacturing techniques.



RESOMER® for Additive Manufacturing

A selection of powders, filaments and granulates for personalized, high-resolution bioresorbable implants

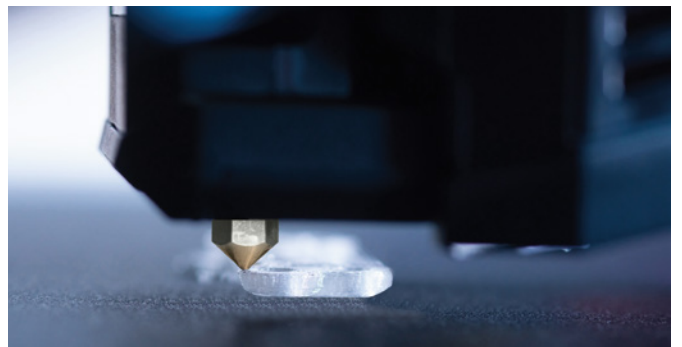


RESOMER® PrintPowder

For Selective Laser Sintering (SLS) technologies

Designed with optimized particle size distribution to enable the consistent flow of high-quality powder in SLS equipment for higher resolution printing.

Featuring excellent compressive strengths and well-defined thermal behavior and crystallinity, these poly(caprolactone) and other powder-based polymers are ideal for patient-specific implants with complex geometries, or where high speed production is required.



RESOMER® Filament

For Fused Filament Fabrication (FFF) technologies

A line of filaments with tight dimensional and chemical specifications including diameter size. Created from RESOMER® polymers including PLLA, PLGA, PCL, and PDO and supplied in medical-grade spools, the line allows degradation times from less than six months to greater than three years. Mechanical properties including strength and elongation at break can be tailored to specific application requirements.

GMP Manufacturing in the U.S. and Germany

For the highest global standards of quality and supply security

Evonik has established two modern GMP production sites for RESOMER® products in the U.S. and Germany to provide medical device companies with the highest levels of quality and supply security.

Each of these facilities are ISO 9001 and ISO 13485 certified, and compliant to IPEC-GMP Good Manufacturing Practices. A full range of inventory is maintained, with multiple options for dual sourcing or back-up supply.

A worldwide network of experts and analytical laboratories are available to provide you with an extensive range of services including:

- Biocompatibility evaluations
- Master Files and technical dossiers
- Other quality services and regulatory support as needed



Evonik Birmingham Laboratories, Alabama, USA



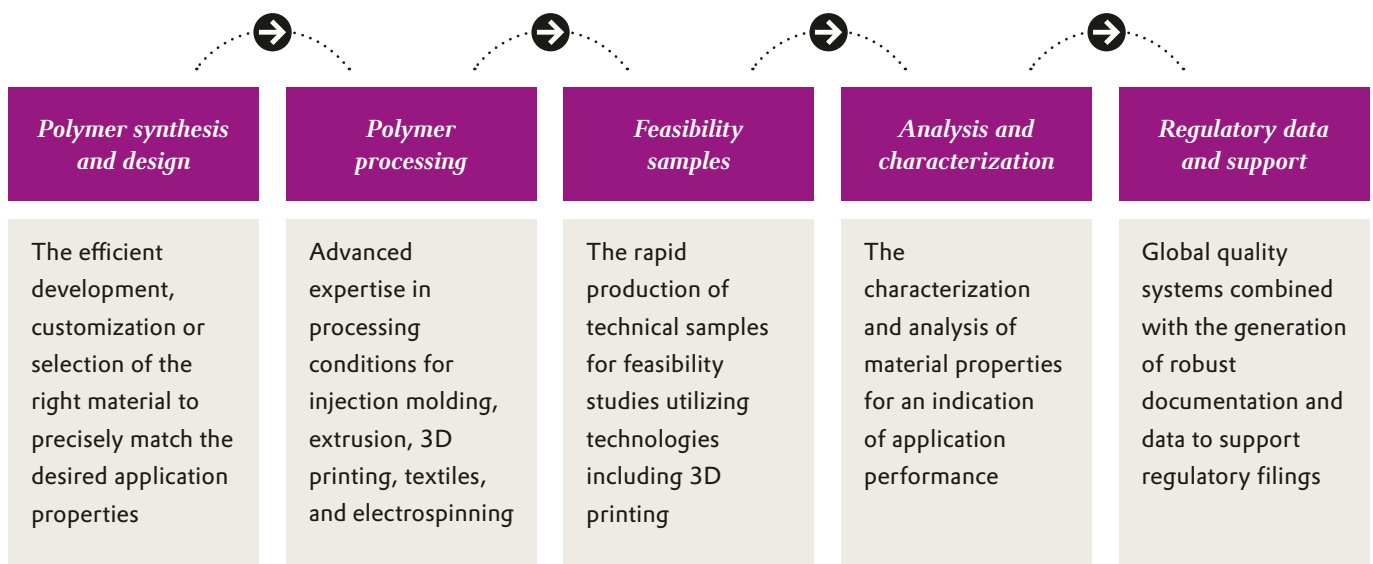
RESOMER® Science Center, Darmstadt, Germany

Application Technology Services

The expertise to reduce project complexity, accelerate speed to market and enhance device performance

Evonik has decades of expertise in the design and production of functional biomaterials suitable for implantable Class II and III medical devices.

Our Medical Device Competence Center in the U.S. and Application Labs in Germany and China ensure responsive and reliable project execution.



This information and all further technical advice are based on our present knowledge and experience. However, it implies no liability or other legal responsibility on our part, including with regard to existing third party intellectual property rights, especially patent rights. In particular, no warranty, whether express or implied, or guarantee of product properties in the legal sense is intended or implied. We reserve the right to make any changes according to technological progress or further developments. The customer is not released from the obligation to conduct careful inspection and testing of incoming goods. Performance of the product described herein should be verified by testing, which should be carried out only by qualified experts in the sole responsibility of a customer. Reference to trade names used by other companies is neither a recommendation, nor does it imply that similar products could not be used.

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