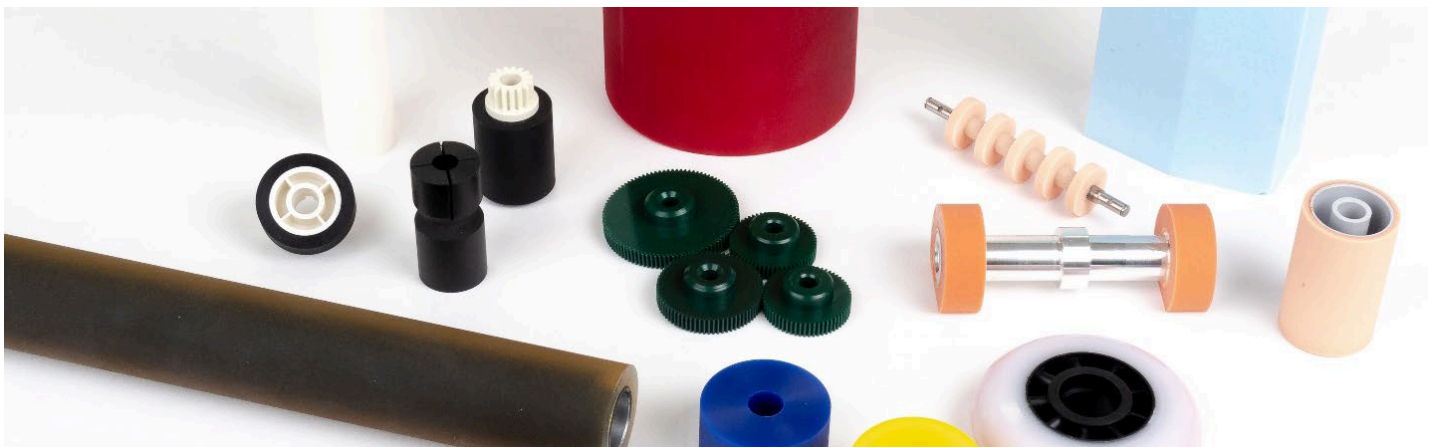


Choosing Thermoset Polyurethane for Medical Device Design

Advancing Medical Device Innovation with Polyurethanes



— INTRODUCTION

In the dynamic realm of medical device manufacturing, the quest for revolutionary materials persists as a significant challenge. This whitepaper is designed to guide product designers with insights into the unparalleled advantages of thermoset polyurethanes, providing a strategic pathway to bring innovative and effective medical devices to market.

Understanding Thermoset Polyurethanes

Thermoset polyurethanes represent a class of polymers known for their superior physical properties and versatile manufacturing techniques. The robust polyurethane structure, formed through intricate chemical reactions between diisocyanates and polyols, sets them apart from their thermoplastic counterparts. The irreversible cross-linking that occurs during the curing process delivers unparalleled versatility, biocompatibility, and durability—essential attributes that are key to pushing the boundaries of medical device innovation.

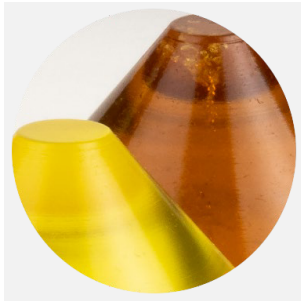
Benefits of Thermoset Polyurethanes in Medical Device Design

Now that we've explored the foundational characteristics of thermoset polyurethanes, let's delve into how these thermoset polyurethanes can directly impact the design and manufacturing of medical devices.



VARIOUS MOLDING TECHNIQUES

Unlocking the potential of thermoset polyurethanes involves exploring diverse molding techniques like cast molding and Reaction Injection Molding (RIM). These methods provide precision and flexibility, enabling the creation of intricate designs from small to large volumes with integrated features such as encapsulated inserts. Furthermore, the rapid prototyping capabilities offered by thermoset polyurethanes facilitate swift validations of form, fit, and function before transitioning to full-scale production.



TAILORED MECHANICAL PROPERTIES

A standout advantage of thermoset polyurethanes is their customizability. Through techniques like cast molding, these polymers can achieve specific conductivity levels, chemical resistance, elasticity, tensile strength, and other crucial mechanical properties. This tailored approach ensures seamless integration into diverse medical devices, optimizing both performance and patient comfort.



BIOCOMPATIBILITY

At the forefront of medical device design is the paramount consideration of biocompatibility. Thermoset polyurethanes shine in this regard, possessing inherent properties that mitigate the risk of adverse reactions during interactions with the human body. This positions thermoset polyurethanes as an optimal choice for applications involving direct contact with bodily tissues.

Thermoset Polyurethanes Compared to Alternative Materials

Material selection plays a pivotal role in shaping medical device performance and patient outcomes. When comparing polyurethanes against traditional materials like metals and plastics, thermoset polyurethanes emerge as a versatile and favorable choice. The chart below highlights some key distinctions for medical device applications:

	THERMOSET POLYURETHANES	METALS	PLASTICS
Flexibility & Strength	Offers unparalleled flexibility & strength across diverse applications	Rigid, with a tendency to lack flexibility	Variable flexibility, may lack optimal strength
Customizability & performance	Highly customizable without compromising performance	Limited customization, with potential challenges in adaption	Some customization options, subject to limitations
Design & Manufacturing Techniques	Allows for unlimited design flexibility through various molding techniques	Generally rigid, posing challenges in intricate & complex designs	Offers design flexibility but less versatile than thermoset polyurethanes
Biocompatibility & Patient Safety	Exhibits excellent biocompatibility, reducing the risk of adverse reactions	Faces challenges in biocompatibility – with potential allergy risks	Varies in biocompatibility – introducing uncertainty in safety measures

Choosing the Right Material

The decision between polyurethanes and traditional materials for medical devices ultimately depends on the specific application and the characteristics your device requires. Material considerations for an informed choice include:

POLYURETHANES

These materials are highly customizable and offer design flexibility, making them ideal for medical devices and components. For instance, if you're designing a wearable medical device that needs to be lightweight and comfortable for the patient, thermoset polyurethanes are an excellent choice. Their ability to be molded into complex shapes can accommodate ergonomic designs.

METALS

Ideal for applications where durability and corrosion resistance are paramount. For instance, a surgical scalpel requires a sharp, durable edge for precise incisions. Stainless steel is the preferred choice due to its resistance to corrosion and the ability to maintain a sharp edge through multiple uses.

COMBINATION OF MATERIALS

The optimal solution may involve a combination of materials like thermoset polyurethanes and metals. This approach allows product designers to leverage the advantages of both materials in a single device. For instance, you might use a metal core for strength and a plastic handle for grip and comfort.

— CASE STUDY

To showcase the transformative impact of thermoset polyurethanes, consider the case study of a provider of mobile imaging systems partnering with Mearthane Products Corporation (MPC).

THE PROBLEM

A provider of mobile imaging systems turned to MPC to improve their recurring mechanical failures. The existing device featured a robust, retractable cord for safety measures and easier transport. While the medical technicians retracted the cord after each session, the cord would snap back at high force, therefore, damaging the machine.

THE SOLUTION

MPC proposed a solid, black 70A elastomeric polyurethane to optimize shock absorption and impact resistance. Based on the customer's design, MPC utilized 3D printed tooling to cast mold a handful of prototypes in the exact material and geometry. This enabled the customer to quickly validate their concept before ramping up to meet production demand and performance requirements.

THE RESULT

The inclusion of this elastomeric polyurethane bumper increased machine uptime and saved the customer thousands in maintenance and repair costs. Moreover, the technicians can safely and quickly retract the cord without damaging any of the mechanical or electrical subcomponents.



Conclusion

In conclusion, thermoset polyurethanes emerge as a transformative material in medical device manufacturing, offering unparalleled benefits in design, customizability, and performance. As demonstrated by the case study, strategic material selection can result in significant improvements in device functionality, durability, and cost-effectiveness. With MPC's expertise and innovative solutions, designers can navigate the intricate landscape of medical device manufacturing, bringing forth a new era of groundbreaking and effective devices to market.

— ABOUT MPC

Mearthane Products Corporation (MPC) is a global technology leader in the development and manufacture of advanced polymer products. With over 50 years of formulation and processing experience, MPC partners with customers to develop innovative solutions to solve the toughest material challenges. Our products are made in the USA and shipped to equipment manufacturers worldwide.

MPC's industry leading Durethane® formulations are engineered for superior performance and can be made into a variety of products using our proprietary casting and reaction injection molding (RIM) processes. Our team of experts can customize solutions to engineer polyurethane properties to meet your exact specifications to produce an infinite variety of shapes and volumes.



Ready to bring your medical device to life?

For more information on MPC's capabilities and experience,
visit www.mpcurethane.com

[Get Started ›](#)