

Case Study

Developing a Custom Material for Trocar Seal Surgical Applications

New custom materials help lead to the latest advances in minimally invasive surgery.

Challenge

Develop a trocar seal material meeting 4 critical properties.

Trocars are surgical instruments placed in the body during laparoscopy. The trocar's seals prevent air from escaping the abdominal cavity while creating an access point for surgical instruments to pass through. The seals also maintain air pressure to provide the surgeon with a clean viewing area during surgery.

An existing Minnesota Rubber & Plastics customer was developing a new trocar seal. Their selected material was failing to work as needed. Of primary concern, some of the more aggressive surgical instruments would catch on the material during insertion, often tearing the seal. This reduced the physician's control over the instruments, disrupted their view of the surgical area and increased potential risk to the patient.

The customer turned to Minnesota Rubber & Plastics to provide a better material for their new seal. The material needed to be tough and tear resistant to withstand a variety of instruments, including scissors, dissectors and graspers. The material also needed to maintain a minimum compression set to ensure consistent performance over the lifetime of the product. Critically the material needed a low coefficient of friction (CoF) to support accurate manipulation of instruments and prevent the snags and tearing that occurred with the original material.

Solution

A custom formulation and process for easier production.

Minnesota Rubber & Plastic's Advanced Material Group (AMG) began work on a formulation that would meet the multiple properties required. The AMG formulation library, and the AMG team's experience with high-performance trocar applications, accelerated the identification of an existing material that closely met the needs of the customer.

The material selected was a polyisoprene (synthetic natural rubber). Polyisoprene has very high elongation (+700%) and tear strength. It snaps back quickly and has good compression-set resistance. It is difficult to cut and, once cut, the cut does not easily propagate.

Using the existing polyisoprene as a base, the team customized the formula to match all of the customer's performance requirements, except for the low CoF.

During development of the custom material, the AMG team determined an advanced secondary process utilizing our proprietary Quniton® surface modification technology could be used to lower the CoF on the seal while improving the manufacturing process. Plus, this secondary process helped to maximize the other properties required from the material while keeping costs down.

In addition to the secondary process, the AMG team drew from their extensive manufacturing experience to improve the customer's seal geometry. The design took advantage of the new material's properties and helped ensure a consistently reliable product could be manufactured at scale.

Results

A material that met the customer's needs in every setting.

By working with the AMG team of experts and utilizing its formulation library, Minnesota Rubber & Plastics delivered a cost-effective material compound that accelerated the speed-to-market of the customer's product. The AMG team's chemical and manufacturing expertise helped produce a seal that enhanced trocar performance, making it a superior solution for physicians in surgery and a leader in the marketplace.



Quick Answers & Results

Minnesota Rubber & Plastics has extensive technical expertise for designing and manufacturing critical sealing components used in niche applications across multiple industries. Engineers like to work with us because they get quick answers and results.

Areas of Expertise

- Rubber and LSR molding
- High-performance bonding and overmolding — plastic to metal or plastic, rubber to metal or plastic
- Custom material formulation
- Injection molding of engineered and high-performance plastics
- Ability to automate as volume requires
- Component and system assembly
- Custom designed seal geometry
- Metal to plastic conversions

Comprehensive Engineering and Manufacturing Capabilities

Minnesota Rubber & Plastics specializes in formulating, designing, manufacturing and assembling rubber, silicone, and high-performance thermoplastics for discerning customers.

Here are just a few of our comprehensive engineering and manufacturing capabilities:

- Preliminary engineering assistance and mechanical design review
- Materials engineering, including specialty compounds
- Extensive analytical and instrument laboratory for development and failure analysis
- Design for Manufacturability (DFM)
- Process engineering, including mold flow analysis, functional and leak testing
- Non-linear FEA

Contact us to learn how we can help you solve your toughest medical device challenges.

Minnesota Rubber & Plastics
1100 Xenium Lane N
Minneapolis, MN 55441

USA: 1 (800) 927-1422
Asia: +86-512 6273 2700
Europe: +33 (0)2 32 22 24 26
mnrubber.com/medicaldevices
customerservice@mnrubber.com

 @mnrubber

 minnesota-rubber-and-plastics



For more than 70 years, Minnesota Rubber & Plastics has helped world-class organizations solve the most difficult sealing and component challenges.

We develop highly engineered, critical-to-function custom molded solutions for the Medical, Transportation, Water, and Food & Beverage markets.

We can support our customers wherever they do business — and our global footprint spans North America, Europe and Asia.

