

# Research at The University of Akron

## Novel Polyurethanes and Polyureas for Biomaterials (UA 659, 694, 768, 803)

Polyurethanes are among the most versatile materials in use today. They are used in everything from rigid foam to adhesives to elastomeric medical devices. Common medical applications of flexible polyurethanes include catheters, general purpose tubing, hospital bedding, surgical drapes, and wound dressings, as well as in a variety of injection molded devices. Their most common application is in medical devices for short-term implants. They offer the advantages of biocompatibility, biostability, durability, toughness, and cost effectiveness.

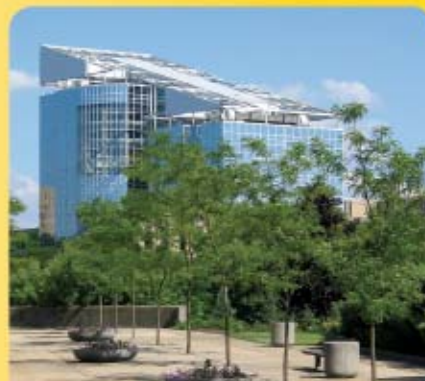
However, polyurethanes as medical devices are often inadequate when subject to the aggressive environments necessary for biomedical applications. They must withstand extended exposure to hostile aqueous fluids and corrosive biochemical environments which are present in the body. New and improved biomaterials with the advantages of urethane functionality, but improved oxidative and hydrolytic stability are needed.

Dr. Joseph Kennedy and his team from The University of Akron have taken their breakthrough invention of polyisobutylene-based thermoplastic elastomers (TPEs), and extended the technology to urethane and urea chemistry. The present invention relates to the discovery of a synthetic route for the production of difunctional alcohol and amine terminated polyisobutylene (PIB) compounds, which can be used as starting blocks for further reactions with isocyanates to produce PIB-based polyurethanes and polyureas. Such thermoplastic polyurethanes (TPUs) show the phase separated microstructure typical of TPEs, with the polyisobutylene segments as the continuous soft phase, and the urethane/urea linkages as the disperse hard domains.

The major advantage of these novel polyurethanes and polyureas is their unprecedented hydrolytic and oxidative stability over any other polymeric biomaterial known in the industry. These materials have been tested in aqueous environments at high temperature, and show no loss of mechanical integrity. In addition, when subjected to highly concentrated oxidative conditions, these materials outperform commercially available biomaterials, AorTech Elast-Eon® and DSM Bionate®. Current research involves optimization of mechanical properties, and has resulted in tensile strength and elongation at 30MPa and 900%, respectively.

### Faculty Inventions and Patents at UA

- Polymer science (88)
- Medical (50)
- Information technology (24)
- Nanotechnology (23)
- Advanced materials (19)
- Biotechnology (7)
- Chemical technology (6)
- Environmental (6)
- Energy (3)
- Security (3)



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### Research at UA

As the public research university of northern Ohio, The University of Akron is connected to the community and to industry, using research as the driver for finding meaningful solutions to advance the region.

**162** – number of active UA patents  
**6,300,000** – 2007 licensing revenue, leading to a statewide first place ranking in rate of return for technology commercialization  
**1** – worldwide ranking in patents issued per research dollar spent, according to a five year study by the Milken Institute  
**24,800** – number of UA students, under the tutelage of 735 full-time faculty members  
**16** – percentage of UA's \$51.7 million 2007 research expenditures funded by industry, the national average is 5 percent

*For more information on The University of Akron's research, inventions, and technology, visit [www.uakron.edu/research](http://www.uakron.edu/research).*

## *About The Faculty Inventor*



Dr. Joseph Kennedy is Distinguished Professor of Polymer Science and Chemistry at The University of Akron. He has had a long and prodigious career as a researcher, scientist, educator, and inventor, both in industry and academia. Dr. Kennedy is very active in commercialization of his research, the most notable example being his invention of the polystyrene-polyisobutylene-polystyrene block copolymer and thermoplastic elastomer (SIBS). SIBS is the biocompatible polymer coating that is used on the world's most popular drug-eluting cardiovascular stent, which has been implanted in about 5 million patients worldwide. His current research is involved with the synthesis of novel biomaterials based on his ground-breaking invention of carbocationic polymerization of polyisobutylene.

### **Invention Information**

**Title:** Polyisobutylenes and Process for Making Same

**Patent Publication:** [WO 2008/066914](#)

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**Inventors:** Dr. Joseph Kennedy  
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**Title:** Polyisobutylenes and Process for Making Same

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