



# Putnam Plastics

Comprehensive Medical Extrusion Technologies

# Solutions for Minimally Invasive Devices

Putnam Plastics, a PolyMedex Discovery Group® company, is a leader in advanced extrusions offering the widest range of capabilities for minimally invasive device companies, from prototype development through full production.



## CUSTOM EXTRUSIONS

### THERMOPLASTICS



#### Materials

We are capable of extruding virtually all melt processed thermoplastic resins, including polyurethane, nylon, PEBA<sup>\*</sup>, PEEK, elastomers, polycarbonate, EVA, PVC, polyolefins, acetals, polyesters, fluoropolymers and more. Thermoplastic resins can be extruded in natural or compounded forms, with additives to affect color, radiopacity, lubricity, anti-microbial and other properties.

#### Configurations

**Multi-Lumen** – Solid rods (beading) to complex multi-lumens provide working channels for the insertion of wires, or the transport of fluids or miniature devices. Available in diameters from 0.005in (0.127mm) to over 1.00in (25.4mm), from round to complex profile shapes inside and out.

**Co-Extrusion** – Multiple materials in a single extrusion, from stripes to encapsulated profiles to four coaxial layers, are required for complex catheter shafts. These include catheters requiring a portion be radiopaque under fluoroscopy and a portion clear for visibility of the lumens; or a hard, lubricious inner surface and soft, bondable outer surface for use in guide wire catheters.

**Taper (Bump)** – Extrusion cross sections can vary in size along their length. Such tapered extrusions are commonly used to create variable stiffness from proximal to distal or to ease connections at the proximal end. Inside diameters can remain constant, while the outside diameter changes along the end.

**TIE™ (Total Intermittent Extrusion)** – A proprietary process resulting in varying durometer (hardness) of an extrusion to vary along the length is commonly used in catheter shafts to provide a soft tip or combination of flexibility and stiffness for insertion.

\*PEBA is a registered trademark of Arkema Inc.

## COMPREHENSIVE SERVICES

**Wire & Fiber Jacketing** – Longitudinal wires or fibers incorporated into an extrusion cross section provide specific benefits, such as structural support or electrical data transmission. Continuous jacketing of thermoset polyimide lumen linings, wires, fiber optics, Kevlar\* reinforcement, and more are available. Discrete jacketing of tapered guide wires (including pre-cut Nitinol\*\* or stainless steel), laser cut and/or tapered hypotubes, micro-coils, are also available.

**Braid & Coil Reinforcement** – Reinforcements applied to single lumen, profile and multi-lumen extrusions include coil to resist collapse and buckling, and braid to improve burst strength and torque transmission. Reinforcement materials include stainless steel, Nitinol, or high tensile polymer fibers.

## THERMOSET POLYIMIDE

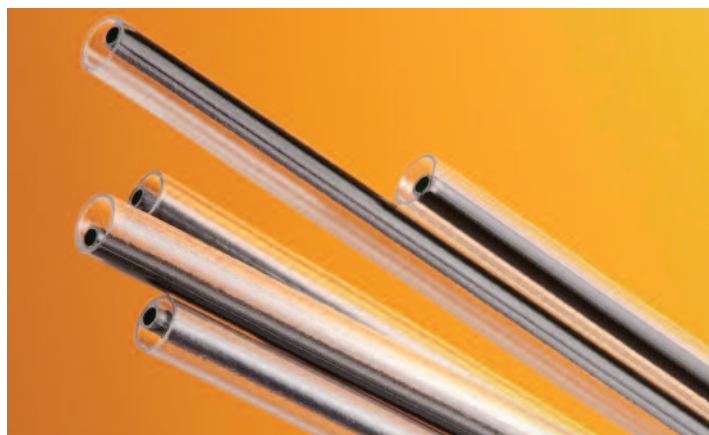
### Materials

The mechanical, thermal, chemical, radiation properties and tight tolerances of thermoset polyimide tubing are unmatched by any other material. Polyimide tubing has been tested and certified to pass Class VI biocompatibility testing. Polyimide tubing is available in a variety of colors and can include PTFE additives for improved chemical resistance and lubricity.

### Configurations

**Single & Multi-Lumen** – While pure polyimide tubing is available only in single lumen configurations, one or more polyimide tubes may be incorporated into a multi-lumen thermoplastic extrusion as lumen lining. Diameters range from 0.006in to 0.090in (0.152mm to 2.286mm) with wall thicknesses ranging from 0.0002in to 0.010in (0.005mm to 0.254mm). Profile shapes such as ellipses and rectangles with consistent wall thicknesses are also available.

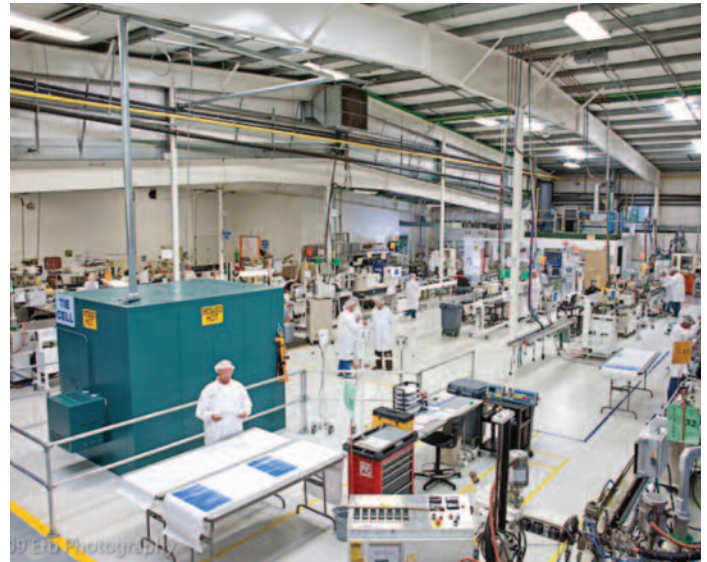
**Braid & Coil Reinforcement** – Thermoset polyimide tubing can be reinforced with stainless steel wires in coil and/or braid configurations. Coil reinforcement provides resistance to collapse and buckling, while braid reinforcement improves burst strength and torque transmission.



\*Kevlar is a registered trademark of E.I. duPont de Nemours and Company  
\*\*Nitinol is a trademark of NDC

## CONTRACT DEVELOPMENT

Over 30 extrusion lines, utilizing extruders in a range of sizes up to 2 inches, (50.8 mm), 3D modeling and finite element analysis tool design, CNC and EDM tool manufacturing, and dedicated clean manufacturing space within our 37,000 square foot (3.5 square meters) facility allow our experienced staff to develop extrusions for challenging minimally invasive applications, scale processes and transition to manufacturing.



## CONTRACT MANUFACTURING

Our state-of-the-art manufacturing facility is ISO 13485:2003 and 9001:2008 certified, reaffirming our goal of maintaining a quality system of the highest possible standard. Fully equipped laboratory for incoming raw materials and on-line statistical process control as well as a vast array of contact and non-contact inspection technologies ensure that every product requirement is met.



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