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## As Catheters Become More Complex, So Do Material Selection and Extrusion

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The trend toward more minimally invasive surgery has increased the demand for more features to be included in catheters without an increase in their size. Often these new catheters include conductors and fiber optics that provide data and video from the surgery site and also deliver power for cauterizing. Copper wires have been used as conductors in the past. However, as the diameter of the copper wire decreases, so does its physical strength, making it no longer usable. Stainless steel is now being used as a material for conducting, but it has more resistance than copper. This problem can be overcome by using gold plating to lower the resistance to acceptable levels.

The smaller size of the catheters also requires them to be made of much tougher materials than their larger counterparts. Often Teflon, FEP, or PFA are used rather than polyethylene or PVC, to maintain physical strength in smaller-diameter catheters.

Tooling used to make the small catheters requires tight tension controls and close tolerance. In order to maintain catheter uniformity, temperature controllers with tight control are also needed, as well as tight speed controls of the extrusion and downstream equipment. Variable-frequency drive motors are now used to provide this increased accuracy for the extrusion line. And active tension devices are used to maintain constant tension on the wires and catheters during extrusion.

### Specialized Extrusions

A wire and cable manufacturer offers experience with a variety of extrudable materials. Silicone, fluoropolymers, FEP and PFA Teflon, Tefzel, Alcryn, fluorosilicone, Hytrel, Santoprene, polyethylene, polyurethanes, and other materials are available upon request. The company supplies products with properties and characteristics such as high flexibility, high-temperature resistance, and ultraminiature constructions. Capabilities extend to composite constructions combining extruded lumens, fiber optics, tubing, and ultralight shielding. Several plating and fiber options are offered for conductor manufacturing. Products are suitable for short- or long-term implants. All components are engineered and produced to customer specifications.
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