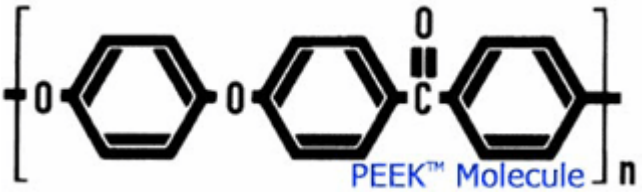
TECHNICAL WHITEPAPER

PEEK vs. Metal: Why Plastic is Better

Introduction

PEEK is a linear aromatic polymer which is semi-crystalline and is widely regarded as the highest performance thermoplastic material. PEEK has repeating monomers of two ether and ketone groups, as shown below:



Understanding the chemical structure gives a better understanding of why the fluoropolymers have such outstanding chemical resistance (and other properties).

PEEK is naturally tan in color and can be pigmented with a wide range of colors, allowing for easy part identification. What sets PEEK apart from fluoropolymers is the fact that PEEK polymer retains its mechanical properties at extremely high temperatures (continuous service temperature of 500ºF/260ºC).

PEEK Replaces Metal Tubing

PEEK is an ideal replacement for stainless steel, other types of metal tubing, and even glass, for weight reduction, comparable strength/mass, chemical resistance, hardness, and low extractables. PEEK most of all is comparable in strength, yet lighter and more cost effective than stainless steel. PEEK is polymer tubing, so the risk of corrosion, outgassing, or leaching (which can cause contamination) is minimal. PEEK is chemically resistant and inert with most acids and bases. PEEK with thin walls can also be made more flexible than stainless steel or titanium tubing, and can easily be cut to length with a razor blade. PEEK is weldable, machinable, and can be used with your existing stainless steel or polymer fittings. PEEK can be bonded with epoxies, cyanoacrylates, polyurethanes, or silicones.

Let's examine some of the most popular uses for PEEK tubing in the sections that follow:

Focus On: HPLC Applications (High Performance Liquid Chromatography)

PEEK has become the gold standard for HPLC analytical science applications due to its purity, high burst pressure, and chemical inertness and resistance. It is also resistant to organic and inorganic solvents. Chromatographers value PEEK for its strength, flexibility, and ease of cutting.

- Purity
- High burst pressure
- Chemical resistance

Focus On: Aerospace Applications

PEEK is particularly useful in the aerospace field for its weight. In an application where two grams can make a difference and where weight is directly correlated to fuel cost, lightweight PEEK tubing is superior to stainless steel. PEEK matches aluminum in mechanical properties, and is more resistant to fluids such as hydraulic fluids. Thinwall PEEK is more flexible and kink resistant than aluminum tubing. PEEK convoluted tubing is also used for its abrasion resistance properties, to protect vulnerable wires located in areas where they could be crushed or severed. PEEK's strength, weight, and heat resistance are ideal for this application.

- Lightweight
- Strength
- Chemical resistance

Focus On: Medical Applications

PEEK can be used in the medical field as a rigid tube in minimally invasive surgery, such as stent delivery. PEEK is also useful in medical applications because of its low coefficient of friction, which does not allow heat to build up, reducing downtime and speeding time-sensitive procedures. For medical devices which require repeated sterilization, PEEK tubing can withstand 3000+ autoclave sterilization cycles. PEEK maintains high mechanical strength, resists stress cracking, and hydrolytic stability in hot water, steam, solvents, and chemicals.

- Biocompatibility
- Mechanical strength
- Resistant to stress cracking

Focus On: Chemical Processing

In the chemical processing industry, PEEK is chosen because it is inherently pure and has outstanding chemical resistance. Unlike most metals, such as stainless steel or aluminum, PEEK can be used in long continuous service applications with virtually no levels of contamination introduced to the chemicals being processed. PEEK has been shown to outperform fluoropolymers with its excellent fatigue resistance and general mechanical properties.

- Inherently pure
- Chemical resistance
- High continuous service temperature (500ºF/260ºC)

PEEK Comparison to Metals		
Steel	**Bronze**	**Aluminum**
PEEK has cheaper manufacturing cost	PEEK has better mechanical properties	PEEK has cheaper manufacturing cost
PEEK has fewer leachables	PEEK is harder	PEEK is harder
PEEK has better dry wear properties	PEEK has better wear & friction	PEEK has better wear & friction

PEEK has better chemical resistance	PEEK has better chemical resistance	PEEK has better chemical resistance
PEEK has 83% Lower Density	PEEK has 85% Lower Density	PEEK has 50% Lower Density
PEEK has less "memory" / chemical absorption & release	PEEK has low outgassing	

Note: For other PEEK properties such as tensile strength etc. see our online Summary of Properties (available in 6 languages): http://www.zeusinc.com/summary_of_properties.asp

How Zeus Can Help

With a technical inside and outside sales force backed up with engineering and polymer experts, Zeus is prepared to assist in material selection and can provide product samples for evaluation. A dedicated R&D department staffed with PhD Polymer chemists and backed with the support of a world-class analytical lab allows Zeus an unparalleled position in polymer development and customization. Since 1966 Zeus has been built upon the core technology of precision extrusion of high temperature plastics. Today, with a broad portfolio of engineered resins and secondary operations, Zeus can provide turnkey solutions for development and high-volume supply requirements.

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