Properties of Materials

Eldon James

Materials - General Information

NYLON — WHITE NYLON • BLACK NYLON — NATURAL NYLON

The invention of nylon in the early 30's, and its introduction in 1938, was truly a major breakthrough in polymer chemistry. No resin has yet been introduced that can begin to match the unique combination of properties that have made nylon the most versatile and broadly used plastic material. Nylon's use as an injection molding material has grown as new applications have emerged across many industries. This growth is driven by continued research and market development, which has led to a wide diversity of product lines.

Eldon James' nylon choice, is one of the three most proven nylon resins. It is a lubricated version of 6/6 Nylon made by the polymerization of hexamethylenediamine and adipic acid, which each contain six carbon atoms (6/6). Of the melt processable nylon homopolymers, the 6/6 nylon series exhibits the highest melting point and a superior dry-as-molded strength and stiffness. It possesses an outstanding balance of properties, combining: strength, moderate stiffness, high service temperature, and excellent toughness. It exhibits low coefficients-of-friction, has excellent resistance to abrasion, and it is particularly resistant to repeated impact. Nylon resists fuels, lubricants, and many chemicals; however, it is attacked by phenols, strong acids, and oxidizing agents. Acceptable sterilization methods include Ethylene Oxide or Autoclave. Visit the Technical Section of our Website @ eldonjames.com for more detail.

• NATURAL NYLON IS NSF/ANSI 61 & 51 Certified •
White and Black Nylon are not NSF/ANSI Certified

GLASS-FILLED BLACK NYLON

The glass fibers provide a minimum average length in the finished part to achieve optimum mechanical properties. The glass is bonded to nylon through the use of certain coupling agents which have been developed to assure retention of physical properties under various environmental conditions. Glass-reinforced nylon is manufactured to give optimum strength combined with excellent injection molding performance. This is achieved by uniform dispersion of the glass fibers in the base nylon.

GLASS-FILLED BLACK NYLON - Offers these advantages over un-reinforced nylon:

- **Ford & GM approval**
- superior tensile strength (over 2 times greater than conventional nylon)
- greater stiffness (3 times greater)
- higher impact strength
- excellent fatigue endurance
- enhanced creep resistance
- excellent retention of tensile strength and stiffness at high temperatures
- better dimensional stability
- superior retention of physical properties when exposed to high temperatures, hot oils, greases, and lubricants
- low thermal expansion (similar to metals)

Materials - General Information

POLYVINYLIDENE FLUORIDE (PVDF)

PVDF has been used as a pipe liner in **chemical processing plants** since its introduction nearly 30 years ago. It has also been used extensively in the **paper and paper pulp industries**, where equipment is constantly exposed to high concentrations of Chlorine and Chlorine Dioxide. In these applications the permeation resistance of PVDF components far surpassed that of PTFE.

PVDF products are used extensively in **silicon microcircuit fabrication**. Processes in this industry commonly use **deionized water**, a fluid that is highly corrosive to steel. The deionized water is often sanitized through the injection of **ozone and exposure to UV light**, both of which can seriously degrade the integrity of materials less durable than PVDF.

Properties of PVDF:

• High thermal stability • High purity • Low permeability to most gases and liquids • High dielectric strength
• Resistance to most chemicals and solvents • Weather resistant-inert to UV radiation • Resistant to fungi
• Mechanical strength and toughness • Resistant to nuclear radiation • Low flame and smoke characteristics

• NATURAL PVDF (material without colorant) is NSF/ANSI Standard 61 & 51 Certified • FDA USP Class VI

POLYPROPYLENE

Polypropylene, like most of the polyolefins, is highly resistant to solvents and chemicals. Polypropylene has outstanding resistance to water and other inorganic environments. It resists most strong mineral acids and bases, but, like the other polyolefins, it is subject to attack by oxidizing agents.
Polypropylene has excellent resistance to environmental stress-cracking. Acceptable sterilization methods include Gamma Radiation and Ethylene Oxide, see sterilization chart for details.

FDA USP Class VI

HIGH DENSITY POLYETHYLENE (HDPE)

When used unmodified for the manufacture of food contact articles, HDPE will comply with FDA 21 CFR177.1520. HDPE also has various applications in medical products. It has excellent resistance to chemicals, excellent toughness, and has an aesthetically pleasing glossy white finish.

• Natural HDPE is NSF/ANSI 61 & 51 Certified •

316L STAINLESS STEEL

316L is a molybdenum-bearing austentic stainless steel which offers a high stress-to-rupture and tensile strength in elevated temperature environments. It is more resistant to corrosion than type Type 304 and It is also more resistant to pitting. Molybdenum-containing stainless steels are used in the manufacture of certain food and pharmaceutical products where minimizing metallic contamination is desirable. Fittings produced with the 316L alloy perform well in harsh physical environments, maintaining their strength and impact resistance under a wide range of temperatures; however, molybdenum-bearing stainless steel is less resistant than other types of stainless steel to highly oxidizing acids, such a nitric acid. The material has wide application in the dairy industry and is accepted by the Dairy and Food Industries Supply Association-Sanitary Standards Committee. It is approved for preparation and storage of foods by the National sanitation Foundation and is used extensively in the brewery, beverage, and bio-processing industries.

Typical Properties of Materials

Property	ASTM Test Method	Kynar	Polypro-pylene	Nylon	Glass filled Nylon	High Density Polyethylene	316L Stainless Steel
TENSILE STRENGTH AT BREAK, PSI	D638	5,400	—	12,000	27,000	1,600	70,000 (ASTM-A240)
ELONGATION AT BREAK %	D638	100-400	375	300	3	320	40 (ASTM-A240)
TENSILE YIELD STRENGTH, PSI	D638	6,500	4,400	12,000	—	3,000	25,000 (ASTM-A240)
FEXURAL MODULUS, KPSI	D790	360	170	410	1,300	138	—
ROCKWELL HARDNESS (R SCALE)	D785	—	R180-102	R121	—	—	—
ROCKWELL HARDNESS (M SCALE)	—	—	M79	—	M101	—	—
SHORE HARDNESS (D SCALE)	D2240	D76-80	—	—	—	—	—
COEF. OF LINEAR THER-MAL EXPANSION, 10-5 IN/IN/°F	D696	7.6	—	4	1.3	—	—
DEFLECTION TEMP. UNDER FLEXURAL LOAD, °F @ 264 PSI	D648	244	—	194	480	—	—
DEFLECTION TEMP. UNDER FLEXURAL LOAD, °F @ 66 PSI	D648	—	190	455	—	—	—
WATER ABSORPTION, %, 24 HOURS	D570	0.015	0	1.2	0.7	—	—
IZOD IMPACT, (NOTCHED), FT-LB/IN	D256	3.1	0.5	1	2.2	0.9	—

Data for Nylon and Glass-Filled Nylon is for dry, as-molded with approximately 0.2% water content.

Absence of entry indicates data not available or not applicable.