Plastics for **Valve and Seal Manufacturers**

BENEFITS OF PLASTIC:

High performance plastics are available in grades that offer the following benefits:

- Moderate stiffness and low creep for consistent sealing performance
- Compatible with a wide variety of industrial chemicals
- Capable of operating from cryogenic to elevated temperatures
- Low friction to achieve the desired actuation torque without the use of external lubricants

Engineering polymers to meet your valve and seal design challenges

The polymers used for the sealing surfaces in valves must have low enough compressive modulus to conform to irregularities in mating metal surfaces while also being strong and stiff enough to maintain a seal. Additionally, plastic valve components must be able to operate in the presence of a wide range of chemicals without degrading from chemical attack and without contaminating the liquid or gas being processed. The plastics that are used for friction and wear surfaces must be carefully formulated with solid lubricants to achieve the desired actuation torque.

Material selection, expert advice

Our plastic material and plastic part design experts work closely with valve and seal designers to identify candidate materials for the most demanding applications.

TYPICAL APPLICATIONS:

- Balls
- Bushings
- Gaskets
- Pintle tips
- Poppets
- Seals
- Valve seats

COMMON MATERIALS:

- Acetal
- DuPont™ Vespel® Polyimide
- FEP
- HDPE
- Nylon
- PAI
- PCTFE
- PEEK
- PFA
- Polypropylene
- PTFE
- PVC
- PVDF
- UHMW

CURBELL PLASTICS

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Properties of Plastic Materials Typically used in Valves, Regulators, and Seals

Importance of Various Material Properties for Valve Design

[1] Approximate Maximum Continuous Service Temperature (°F) is useful (but incomplete) information for determining the upper service temperature limit for a polymer. Compressive Modulus (kpsi) is important because the plastic must be soft enough to conform to surface irregularities on mating metal parts and stiff enough to maintain a seal under pressure or vacuum. [2] Coefficient of Thermal Expansion (in/in/°F x 10^{-5}) is important to consider because the CTE of the mating plastic and metal parts should be as close as possible to insure proper fit throughout the operating temperature range. Friction and Wear Grades Available – low coefficient of friction grades are important when actuating a valve involves the polymer component sliding against a mating metal component.

PROPERTIES OF PLASTIC MATERIALS TYPICALLY USED IN VALVES, REGULATORS, AND SEALS

Material Property	[1] Approximate Maximum Continuous Service Temperature (°F)	Compressive Modulus (kpsi)	[2] Coefficient of Thermal Expansion (in/in/°F x 10^{-5})	Friction and Wear Grades Available	Technical Notes
Test Method (unless otherwise noted):	---	**ASTM D695**	**ASTM D696**		
Acetal	212	[5] 334 to 392	6.8	Delrin® AF 100 Blend TECAFORM® AD HPV13	Available in homopolymer (Delrin®) and copolymer grades.
DuPont™ Vespel® Polyimide SP-1	500	350	[6] 3	DuPont™ Vespel® SP-21 DuPont™ Vespel® SP-211	Moderate compressive modulus from cryogenic to extremely high temperatures.
FEP	392	64 to 78	4.4 to 8.3		High purity, chemically resistant fluoropolymer.
Fluorosint® Filled PTFEs	500	110 to 250	[7] 2.5 to 5.7	Fluorosint® 207 Fluorosint® HPV	Dimensionally stable filled PTFEs with improved creep resistance and wear performance.
25% Glass-Filled PTFE	500	103 to 112	[7] 5.6	25% Glass-Filled PTFE	Glass filler increases strength and modulus and improves creep resistance and dimensional stability compared with unfilled PTFE.
HDPE	170	115	7.9 to 10.0		Low temperature, low strength polyolefin with broad chemical resistance.
Nylon (Type 6, Cast)	230	325 to 400	6.1	MD-Filled Cast Nylon	Available in multiple formulations. Can be cast as large tubular bars.
PCTFE	380	[3] 171 to 240	3.9		Fairly stiff (for a fluoropolymer). Good flammability properties. Widely used in aerospace applications.
PEEK	480	500	[7] 2.6	TECAPEEK® PVX	Broad chemical resistance and high purity. Wide operating temp. range.
PFA	500	100	6.7		High purity, chemically resistant fluoropolymer with superior thermal stability.
Polypropylene	180	200	4 to 6		Low temperature, low strength polyolefin with broad chemical resistance. Stronger and stiffer (but less ductile) than HDPE.
PTFE	500	80	[4,6] 8.9	PTFE	Very low friction fluoropolymer. Unfilled PTFE has a very high CTE and poor creep characteristics.
PVC	140	350	3.2		Low cost, rigid material. Easy to weld via thermoplastic welding and easy to bond with solvent cements.
PVDF	302	[5] 276	6.6 to 8.0		Fairly stiff (for a fluoropolymer). Good flammability properties. Widely used in aerospace applications.
Torlon® 4203 PAI	500	478 to 580	[7] 1.7	Torlon® 4301	Extremely strong and stiff polymer with excellent high temperature properties.
UHMW-PE	180	80 to 100	11.1	LubX® C	Low temperature, low strength polyolefin with broad chemical resistance. Very good abrasive wear resistance.

Engineering Notes: [1] The actual upper temperature limit for a polymer for a particular application is a complex issue. It is important to consider changes in mechanical properties, creep, stress relaxation, thermal expansion, and chemical resistance at the specific temperature as well as the thermal degradation behavior of the polymer when determining the temperature at which a plastic can be used. [2] Many of Curbell's materials are available with fillers in the formulation for improved dimensional stability. [3] The compressive modulus of PCTFE varies as a function of its crystallinity. [4] The CTE of PTFE varies significantly as a function of temperature. [5] Test Method: EN ISO 604. [6] Test Method: ASTM E228. [7] Test Method: ASTM E831.