Protolis

Plastic Grades for CNC Machining

Materials	Other names	Descriptions	Limitations	Applications	Price index	Natural color	Color match	Density - g/cm3	Water absorption ASTM D570 - %	Hardness ASTM D2240 - Shore D	IZOD impact (Notched) ASTM D256 - J/m	Yield tensile strength ASTM D638 - Mpa	Elongation at break ASTM D638 - %	Flexural strenght ASTM D790 - Mpa	Flexural modulus ASTM D790 - Mpa	Heat deflection temperature at 66 psi ASTM D648 - °C / °F	Glass transition temperature - °C / °F	Inflammability - UL94
ABS	Acrylonitrile Butadiene Styrene	Acrylonitrile Butadiene Styrene is low cost plastic easy to machine. Good impact resistant, stiffness & strength. Good dimensional stability and low water absorption Good machinability and bonding, easy for paint and electroplating	Not suitable for petroleum-based oils and solvents. Moderate resistance to heat, chemical, fatigue and UV light.	General household items: gardening tool, toys, kitchen appliances, electrical/electronic appliances Widely use for pre-production prototype of housings, covers and structural components	1	Beige / Black / White	N/A	1,05	0.3 - 0.8	100	200 - 215	27.6 - 55.2	10 - 50	66,7	2100 - 2800	98°C / 208°F	105 °C / 221°F	HB
ABS/PC	-	Plastic blend of ABS & PC, the properties are controlled by the ratio of PC & ABS. It includes the benefits & limitations of both. The durability of ABS plus the impact strength of PC makes the compound bendable but not easy to break.	Poor resistance to solvents	Similar to ABS applications requiring better impact strength Electrical/electronic product shell Automotive interior	2	Black / White	N/A	1,13	0.2 - 0.3	62 - 85	196	41	60 - 85	68	1500 - 2800	110°C / 230°F	120°C / 248°F	HB
PC	-	Polycarbonate is a good alternative to glass with high transparency High resistance to impact and good temperature resistance Good electrical insulation, excellent dimensional stability, low water absorption Good machinability and bonding, easy for paint and electroplating	Moderate resistance to chemicals, Moderate UV resistance,	Applications requiring transparency and high impact resistance Exterior and interior automotive parts Exterior lighting	2	Transparent/black/white	N/A	1,2	0.15 - 0.2	90 - 95	600 - 850	59 - 70	50 - 120	90 - 103	2100 - 2600	140 °C / 240° F	147°C / 296°F	V2
PMMA	Acrylic, Plexiglas	Kown as acrylic, PMMA is one of the clearest plastic, lighter alternative to glass, and economic substitute for PC but with lower impact strength. High resistance to scratch, UV & weather resistant Good dimensional stability, low water absorption Good machinability and bonding, easy for paint and electroplating	Poor resistance to impact, wear and abrasion Easy to crack under load Limited heat and chemical resistance	Construction outdoor applications Automotive light parts Electronic screens Cosmetic packaging and display	1	Transparent	N/A	1,19	0.1 - 0.4	90 - 99	20 - 22	70	2 - 10	100	2900 - 3100	105 °C / 220° F	116°C / 240°F	HB
POM - C	Delrin, Acetal	Thermoplastic with hight strength, stiffness & toughness. Excellent bearing, wearing & sliding properties, High tensile strength, resistant to impact, temperature & heat Chemical resistance (hydrocarbons & solvents), Good dimensional stability and low moisture asborption.	Impossible to bond and paint Poor resistance to acids, Prone to warpage	Commonly used as bushings, rollers, wear strips, gears, pump parts	2	Black / White	N/A	1,41	0.11 - 0.5	80 - 95	69 - 100	61 - 67	15 - 65	83 - 91	2600 - 2880	160 °C / 320° F	80°C / 176°F	HB
PP	-	Polypropylene is one of the lightest thermoplastics available with excellent resistance to fatigue and chemical resistance (most alkaline & acid) Low moisture absorption and non-toxic.	Impossible to bond and paint Low resistance to UV Burning very quickly	Packaging industry Household appliances Eelectric appliances Automotive decorative parts	1	White / grey	N/A	0,9	0.01 - 0.1	70 - 83	60 - 70	23 - 33	200 - 500	31 - 40	1300 - 1800	50 - 100 °C 122 - 212 °F	25°C / 77°F	HB

PET	-	Polyethylene terephthalate is a plastic with high mechnanical strenght, excellent wear resistance and good sliding property. Excellent chemical resistance and good electrical insulator Good dimensional stability and very low moisture absorption.	Not durable in case of sudden impacts, especially under temperatures below zero	Accurate automotive parts Electricity and electronics appliances Domestic appliance Food packaging	2	White/black	N/A	1,37	0.1 - 0.2	85 - 95	41.2 - 53.9	60	30 - 70	80 - 105	1000 - 2000	75 °C / 167°F	100°C / 212°F	HB
HDPE	-	High density polyethylene is a light-weight and flexible plastic with good resistance to impacts, breaks and abrasion. Good electrical insulation. Excellent resistance at low temperature and good chemical resistance Good dimensional stability with low moisture absorption.	Impossible to bond and paint Lower stiffness compared to Polypropylene. Poor UV resistance.	Construction: pipe, tanks, water storage Mechanical equipment parts Electronic appliances Food packaging and container	1	White / black	N/A	0,96	0.005 - 0.01	60 - 70	>50	30 - 40	500 - 700	20 - 40	600 - 1500	50°C / 122°F	100°C / 212°F	HB
LDPE	-	LDPE shares most of the characteristics of HDPE It is softer and more flexible and more likely to crack under stress.	Similar to HDPE	Houshold application: hinge Electronic appliances Food packaging and container	1	White	N/A		0.005 - 0.015	40 - 50	999 (Don't break)	4 - 20	200 - 600	14	2700 - 3000	70°C / 158°F	80°C / 176°F	HB
UHMW-PE	-	Ultra high molecular weight polyethylene also called HDPE 1000 has a unique combinaison of wear and corrosion resistance, low friction surface and impact strength. Good electrical insulation and high chemical resistant Good dimensional stability and no moisture absorption.	Poor UV resistance Subject to stress cracking Impossible to bond	Mechanical and electrical engineering Construction industry Food industries	3	White / black	N/A	0,93	0,01	62 - 66	999 (Don't break)	49	250 - 400	27	2400 - 3200	200°C / 392°F	49°C / 120°F	HB
PVC	-	Polyvinyl chloride is a polymer with normal impact strengh, good tensile strenght and stiffness. Exceptionnal chemical and corrosion resistance Good dimensional stability, no water absorption and self-extinguishing Good machinability and bonding.	Low UV resistance, Poor heat stability and low temperature resistance	Construction industry: pipes, windows and doors frames. Automotive parts Medical devices	1	Grey / transparent	N/A	1,4	0.04 - 0.4	65 - 90	20 - 110	47 - 62	25 - 80	72 - 91	2800 - 3300	200°C / 392°F	49°C / 120°F	V0
PA6	Nylon 6	Polyamide also called nylon is a light plastic with good tensile strength and stiffness (comparable to metal), excellent resistance to bearing, fatigue and abrasion. Excellent corrosion resistance and electrical properties. Good machinability.	Moisture absorption that can greatly reduce mechanical strength and electrical performance Poor UV resistance and dimensional stability Impossible to bond and paint	Construction material Automotive parts Aircraft parts Electronic & electrotechnical parts	2	Milk white / blue / black	N/A	1,13	1.6 - 1.9	80 - 95	50 - 53	74 - 100	<=67	80 - 100	1600 - 2400	150°C / 302°F	45°C / 113°F	HB
PA66	Nylon 66	The chemical and physical properties of PA66 are similar to those of PA6. PA66 has slightly less water moisture absorption, higher mechanic properties and better short term heat resistance.	Slighty better than PA6	Construction material Automotive parts Aircraft parts Electronic & electrotechnical parts	2	Milk white / blue / black	N/A	1,15	1 - 3	80 - 95	53 - 58.7	85	46 - 70	110 - 140	4065 - 4275	> 260°C / 500° F	145°C / 293°F	HB
PBT	-	Polybutylene terephthalate is a engineering thermoplastic with excellent mechanical (high strength and toughness) and electrical insulation. Good resistance to UV and to chemicals. Wide range of temperature usage (-40℃ to 110°C). High dimensional stability and low moisture absorption. Good machinability.	Prone to warping Sentitive to hot water	Food industry Electrical & electronic appliances: connector strips and insulating housing Household appliances Medical equipments	3	White/black	N/A	1,31	0.07 - 0.2	90 - 95	47 - 90	58	5 - 43	50 - 85	3800 - 4200	> 260°C / 500° F	85°C / 185°F	HB

PTFE	Teflon	Polytetrafluoroethylene, also known as Teflon, is a thermoplastic polymer with best performance in temperature, excellent chemical resistances, self lubricant and wear resistant with extremely lowest friction coefficient. Excellent electrical insulation, no water absorption and good UV resistance. Self extinguishing, naturally flame retardant UL 94-V0.	Impossible to bond and paint	Chemical industry: temperature sensor casing, gaskets, chemical tank, Medical applications Fire equipments	3	White/black	N/A	2,2	0.005 - 0.01	50 - 65	170	25	200 - 400	50	5000 - 7000	120°C / 248°F	126°C / 258°F	V0
PEEK	-	Polyetheretherketone is high-performance thermoplastic with excellent chemical resistance and low moisture absorption. Good wear, abrasion and fatigue resistance and excellent tensile strength. High-temperature resistance and naturally UL94 V-0 (low-toxicity gas if burnt). Good dimensional stability and good machinability.	Impossible to bond and paint Low UV light resistance	Used in many of the most critical areas in general industries: automotive, marine, medical, aerospace	5	Beige	N/A	1,31	0.1 - 0.5	85 - 95	120	>=90	15 - 50	150	4065 - 4275	> 260°C / 500° F	145°C / 293°F	V0
PPS	-	Polyphenylene sulfide is advanced engineering plastic with properties similar to metal with exceptionnal mechanical strenght, excellent wear resistance and fatigue endurance. Good electrical insulation. High-temperature resistance and naturally UL94 V-0. Exceptionnal chemical resistance and no moisture absorption. Good dimensional stability and good machinability.	Brittleness Impossiple to bond	Automotive: seals, fuel and brake systems Mechanical engineering: pump and valve components Electrical/Electronic components: connectors, contact rails, Medical industry	4	White	N/A	1,3	0.01 - 0.07	86 - 92	5 - 25	65 - 85	4 - 8	50 - 80	3800 - 4200	> 260°C / 500° F	85°C / 185°F	V0