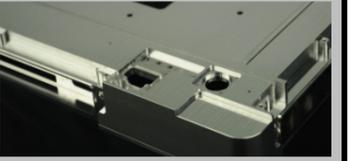


Materials Selection Guide for CNC Machining 1/2		ABS	Polycarbonate (PC)	Acrylic (PMMA)	Acetal (POM)	Nylon (PA)	Polypropylene (PP)	ALUMINIUM
								
Material Overview	Description	This low-cost engineering plastic offers exceptional mechanical and surface strength for a wide range of parts used in high-impact applications.	Unfilled PolyCarbonate (PC) is a tough and durable, transparent engineering thermoplastic notable for its high impact resistance, temperature resistance and optical properties.	Also known as PMMA (PolyMethyl-MetaAcrylate) is an amorphous thermoplastic material with very good optical properties. Acrylic is often used as a glass substitute. Acrylic is hard and stiff but brittle and notch sensitive.	Acetal also known as POM (PolyOxyMethylene) is an engineering Thermoplastic often used for precision components that require high stiffness, low friction and excellent dimensional stability.	Nylon is a generic designation for a family of synthetic polymers known generically as PA PolyAmides. Nylons (Polyamides) comprise the largest family of engineering plastics with a very wide range of applications. Nylons are generally Strong, Tough and Wear Resistant.	PolyPropylene is semi-opaque thermoplastic widely used in variety of applications. Polypropylene has good resistance to fatigue. PP offers a combination of outstanding physical, chemical, mechanical, thermal and electrical properties.	Aluminium is the most widely used non-ferrous metal. Aluminium is a soft, Durable, Lightweight, Ductile and Malleable metal with appearance ranging from Silvery to Dull Grey, depending on the surface roughness. Aluminium naturally generates a protective oxide coating and is highly corrosion resistant.
	Characteristics	Easily machined, thermoformed and heat-formed, ABS can also be painted and glued for added versatility. Excellent thermal and dimensional stability expand its machinability to preproduction prototypes.	High Impact resistance, Good Dimensional Stability, Excellent strength retention at elevated temperatures, Low coefficient of thermal expansion, Good Dimensional Stability. Good electrical insulator and having Heat resistant and Flame retardant properties.	Excellent optical clarity, Good Abrasion Resistance, Excellent environmental stability, Good Heat Resistance, Good Chemical Resistance. Flammable but low smoke emission.	Excellent abrasion resistant Good working temperature, Glossy appearance, Excellent durability Self-lubricant Good stiffness, strength & Hardness. Wide range Chemical resistance (including many solvents). Good Electrical and Dielectric properties.	Excellent abrasion resistance, High elongation, Good resistance to fuels, oils and solvents but is affected by acids and strong bases. Good Toughness, High Tensile Strength, High Impact Resistance, Good Dimensional Stability.	Excellent resistance to fatigue. Lightweight with good combination of toughness and flexibility. Resists most alkaline and Acids. Low moisture Absorption and Non-Toxic. Good Impact Resistance. Retains stiffness and flex.	Aluminium is an Excellent Heat and Electricity conductor, Excellent Corrosion resistance, Non-Magnetic and Non-Sparking. Aluminium is 100% recyclable without any loss of its natural qualities. Aluminium is a good reflector of visible Light and Heat.
	Applications	General Household items, Toys, Automotive Parts, kitchen Appliances, Computer Parts, Laboratory Equipment, Phone/Fax machine parts, Electrical/Electronic enclosures, Aircraft and automotive interior trims	Automotive headlamp Lenses and Safety Shields, Medical/Healthcare apparatus, Automotive Applications, Construction Industry, Sporting Goods, Appliances, Casing and housings, Electrical/Electronic components, Connectors, Compact Discs, Telecommunication Hardware	Automotive light covers, Lighting fixtures, Clear Bottles and Container prototypes, Lenses, Shop-fittings, Aircraft glazing, Novelty display cases, Signs, Appliances, Modern furniture, Jewelry items, Medical/Healthcare Applications. PMMA has a good degree of compatibility with human tissues.	Gears, Bearings, Screws, Pump parts, Electronic components, Insulators, Medical parts, Furniture hardware, Valve bodies, Zippers, Underwater applications.	Ideal for wear applications such as Bearings and Gears, Sporting Goods, Fishing line, Automotive Parts, Tanks, Engineering Parts, Power Tools, Intake Manifolds.	Appliance housings, Food Packaging, Medical and Laboratory applications because it can withstand the heat in an autoclave, Pump Components, Casings with Living Hinges, Automotive parts, Food Containers, Industrial Applications, Loudspeaker drive units, Household Goods.	Large number of components for Automobiles, Aircraft, Trucks, Trains. Packaging application like beverage cans, foils. Construction industry, Wide range of household items, Consumer Electronics, Heat sinks for electronic appliances.
	Finish Available	Machine Finish, Smooth Finish, Sand Blast, Polished Finish, Painted or Grey Primered, Electroplated	Machine Finish, Smooth Finish, Sand Blast, Mirror Polish, Vapor Polish, Translucent finish (Foggy look like Lamp Shade), Painted or Grey Primered	Machine Finish, Smooth Finish, Mirror Polish, Flame Polish, Translucent Finish, Painted or Tinted finish	Machine finish, Smooth Finish, Sand Blast, Polished finish	Machine Finish, Smooth Finish, Sand Blast.	Machine Finish, Smooth Finish, Sand Blast.	Machine finish, Polished finish, Mirror Polish, Brushed polish, Bead Blast (To give a Matt textured finish), Anodising, Painting, Powder Coating.

Materials Selection Guide for CNC Machining 2/2		ABS	Polycarbonate (PC)	Acrylic (PMMA)	Acetal (POM)	Nylon (PA)	Polypropylene (PP)	ALUMINIUM
Material Overview	Remarks	Natural raw material is available in Cream White colour. Large and complex parts with undercuts can be easily made in sections and glued. Economical option for prototypes.	Typically parts have translucent look after machining but transparency can be achieved by highly polishing. It's strength, durability, impact resistance and transparency make it an ideal material for certain structural applications. Large and complex parts with undercuts can be made in sections and glued.	PMMA is an economical alternative to Polycarbonate (PC) when extreme strength is not necessary. Common trade names of Acrylic include Plexiglas, Lucite and Perspex. Large and difficult parts can be easily glued.	Easy to machine but very difficult to bond. Good appearance with gloss finish. Acetals often compete with Nylons for many of the same applications but dimensionally stable than Nylon under wet and humid conditions.	Nylons are commonly used in textiles, automotive, carpet and sportswear due to their extreme durability and strength. Nylon has better wear-resistance than Acetal, but do not have good moisture resistance which makes it unsuitable to high-humidity.	Polypropylene is one of the lightest plastics available. Easy to machine and provide smooth finish. Since PP is resistant to fatigue, makes it suitable for most of plastic living hinged parts, such as flip-top bottle caps.	Aluminium is a very light metal with a specific weight of 2.7 g/cm ³ , about a third that of steel. We use Aluminium 6061 and Aluminium 5083 grades for machining.
	Weaknesses	Not suitable for Petroleum-based oils, paints and solvents. Moderate heat, moisture and chemical, weathering resistance. Can easily scratch. Flammable with high smoke generation.	Subject to cracking due to stress, Moderate resistance to Chemicals, Low scratch-resistance.	Poor impact resistance, Subject to stress cracking, Not suitable for use with chlorinated or aromatic hydrocarbons. Brittle nature, PMMA swells and dissolves in many organic solvents.	Very difficult to bond, Poor resistance to acids, Flammable and High Specific Gravity. Difficult to paint. Large and thin parts with irregular wall section are prone to warpage.	High Moisture absorptivity degrades electrical and mechanical properties. Attacked by strong Acids, Bases, Oxidizing agents. High Notch sensitivity.	Hard to Glue. Degraded by UV radiation, Attacked by chlorinated solvents and aromatics. Large and thin wall sectioned parts are prone to deformation or warpage after machining.	Unlike steels, Aluminium alloys have no well-defined fatigue limit, meaning that fatigue failure eventually occurs, under even very small cyclic loadings. Subject to internal stresses following heating operations such as welding and casting due to low melting point.
	WayKen's types of materials	ABS - Natural ABS - Black ABS - Flame Retardant UL-94V0	PC - Clear PC - Black PC 20% GF - Black	PMMA - Clear PMMA - Black	Acetal - Natural (White) Acetal - Black	Nylon 6/6 - Natural (White) Nylon 6/6 30%GF - Black	PP - Natural PP - Black PC 20% GF - Black	Aluminum 6061 Aluminum 6061-T6 Aluminum 7075
Properties Parameters	Density (g/cm ³)	1.06	1.2	1.18	1.41	1.14	0.9	2.7
	Water Absorption (%)	0.25	0.15	0.4	0.27	1.9	0.03	---
	Tensile Strength (Mpa)	38	64	70	67	75	33	---
	Tensile Modulus (MPa)	2100	2200	2800	2900	2300	1300	---
	Elongation at break (%)	35	75	10	40	90	185	---
	Izod impact Strength Notched (J/m)	300	750	22	100	100	60	---
	Flexural Strength (MPa)	65	90	96	87	80	45	---
	Flexural Modulus (MPa)	2000	2300	3200	2900	3000	1550	---
	Heat Deflection Temp - 0.46MPa ©	98	138	110	165	200	100	---
Heat Deflection Temp - 1.8MPa ©	94	130	95	125	90	50	---	