

Material selection: Evaluating the specifications

Whether metal, polymer, ceramic or composite, one approach used by many design engineers to select the appropriate material is to draw up an engineering specification which details the physical properties, appearance, processing technique, costs and any other important criteria. However, if you lack precise engineering requirements and simply want to quickly identify a short list of candidates, simply list the characteristics you desire, starting with the most important, and gradually eliminate materials that don't fit your requirements.

For example, let us assume you need to produce a plastic component that has a low density, is transparent, resistant to solvents, and can be injection moulded. Although cost can be an important part of your evaluation process, if the component can be reused after a suitable cleaning process, this needs to be included in the calculation.

	Low density	Transparent	Solvent resistance	Injection Moulding	Steam sterilisable	Cost
Polymethylpentene (TPX®)	0.833 g/cc	Clear	Excellent	Yes	Yes	Medium-high
Polysulphone (PSu)	1.24 g/cc	Amber tint	Fair/Good	Yes	Yes	High
Polycarbonate (PC)	1.2 g/cc	Clear	Poor	Yes	Limited	Medium
High Density Polyethylene (HDPE)	0.95 g/cc	Clear/hazy	Excellent	Yes	Limited	Low
Polymethylmethacrylate (PMMA)	1.19 g/cc	Clear	Poor	Yes	No	Low-medium

From this exercise, [TPX®](#) would appear to be the most suitable material for this particular application. However, if we stay with the same short list, but change some of the desired properties to place greater importance on operating temperature, and eliminate the need for solvent resistance and sterilisation, the order changes:

	Heat distortion temperature (HDT) 0.45 MPa	Solvent resistance	Low density	Transparent	Injection moulding	Cost
Polysulphone (PSu)	182°C	Fair/Good	1.24 g/cc	Amber tint	Yes	High
Polycarbonate (PC)	140°C	Poor	1.2 g/cc	Clear	Yes	Medium
Polymethylmethacrylate (PMMA)	105°C	Poor	1.19 g/cc	Clear	Yes	Low-medium
Polymethylpentene (TPX®)	100°C	Excellent	0.833 g/cc	Clear	Yes	Medium-high
High Density Polyethylene (HDPE)	75°C	Excellent	0.95 g/cc	Clear/hazy	Yes	Low



Material selection: Evaluating the specifications (Continued)

Polymer terminology

The material selection process can be a little daunting if you are not familiar with all of the terms used in connection with the type of material you require. Here are a few of the more commonly used terms related to polymers:

- Thermoplastic – a plastic material that will soften and/or melt when heated
- Thermoset – a polymer which does not soften or melt when heated
- Amorphous – a plastic material where the polymer chains are randomly arranged (no order)
- Semi-crystalline – a plastic material where the polymer chains have regions of order
- Heat distortion temperature (HDT) – the temperature at which a polymer will start to distort, usually determined by applying a load of 0.45 MPa or 1.8 MPa
- Uniaxially oriented – the condition in which a polymer has been stretched in one direction (usually longitudinally), leading to an increase in strength
- Biaxially oriented – the condition in which a polymer has been stretched both longitudinally and laterally, once again leading to an increase in strength

Click [here](#) to download a data table for all polymers.

The Goodfellow technical sales team is always available to discuss your application and help you select the most suitable material. Just email us at info@goodfellow.com or call 0800 731 4653 (UK) or +44 1480 424800.

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