3D Mechanical Design Drafting 3D Printing

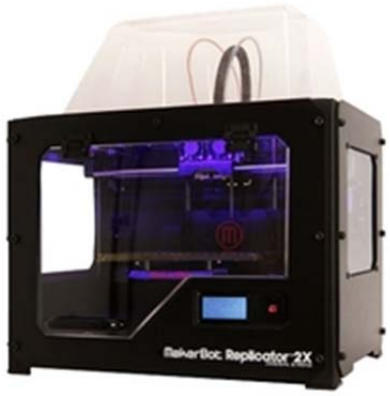
[Basic Information]

Making Solid Physical Objects out of Melted Filament.

3D Printing (Rapid Prototyping) is a cost effective process that produces a physical model from your 3D Cad Model. It allows you the to get a physical feel for your product before any expensive tooling or machining has begun. Can be printed in a variety of materials and colours.

Fused Filament Fabrication (extruding filament) is used, Materials available ABS & PLA, Maximum Build Volume 236 x 142 x 150 [larger models can be made by joining them together] , Resolution of 0.1mm to 0.3mm Layers & 1 or 2 Colour per print available.

First and foremost we need a 3D cad converted to a good quality STL file. We can convert a 3D cad model if required, Also best to have the native 3D cad model available as sometimes model tuning is required to suit the print process. If you don't have a 3D cad file we can create it, at a competitive rate.



The Equipment and Process.

MakerBot Replicator 2X "Experimental Dual Extruder" Stratasys 3D Printer makes solid, three-dimensional objects out of melted MakerBot Filament, using ABS or PLA in various colours. Your 3D design files are translated into instructions for the MakerBot Replicator 2X and read by the machine via SD card or USB Cable. The MakerBot Replicator 2X then heats the MakerBot Filament and squeezes it out through a Ø0.4mm nozzle) onto a heated surface to build a solid object, layer by layer. Fused Filament Fabrication [FFF] or Fused Deposition Modelling [FDM]
NOTE- Models with thin walls (less than 1.6mm) and excessive overhangs (over 45° off vertical) DO NOT print well and will probably fail.

General Material Properties

ABS - ABS as a polymer can take many forms and can be engineered to have many properties. In general, it is a strong plastic with mild flexibility (compared to PLA). Natural ABS before colorants have been added is a soft milky beige. The flexibility of ABS makes creating interlocking pieces or pin connected pieces easier to work with. It is easily sanded and machined. Notably, ABS is soluble in Acetone allowing one to weld parts together with a drop or two, or smooth and create high gloss by brushing or dipping full pieces in Acetone. Compared to PLA, it is much easier to recycle ABS.

Its strength, flexibility, machinability, and higher temperature resistance make it often a preferred plastic by engineers and those with mechanical uses in mind.

PLA - Created from processing any number of plant products including corn, potatoes or sugar-beets, PLA is considered a more 'earth friendly' plastic compared to petroleum based ABS. Used primarily in food packaging and containers, PLA can be composted at commercial compost facilities. It won't bio-degrade in your backyard or home compost pile however. It is naturally transparent and can be colored to various degrees of translucency and opacity. Also strong, and more rigid than ABS, it is occasionally more difficult to work with in complicated interlocking assemblies and pin-joints. Printed objects will generally have a glossier look and feel than ABS. With a little more work, PLA can also be sanded and machined. The lower melting temperature of PLA makes it unsuitable for many applications as even parts spending the day in a hot car can droop and deform.

Part Accuracy

Both ABS and PLA are capable of creating dimensionally accurate parts. However, there are a few points worthy of mention regarding the two in this regard.

ABS - For most, the single greatest hurdle for accurate parts in ABS will be a curling upwards of the surface in direct contact with the 3D Printer's print bed. A combination of heating the print surface and ensuring it is smooth, flat and clean goes a long way in eliminating this issue. Additionally, some find various solutions can be useful when applied beforehand to the print surface. For example, a mixture of ABS/Acetone, or a shot of hairspray.

For fine features on parts involving sharp corners, such as gears, there will often be a slight rounding of the corner. A fan to provide a small amount of active cooling around the nozzle can improve corners but one does also run the risk of introducing too much cooling and reducing adhesion between layers, eventually leading to cracks in the finished part.

PLA - Compared to ABS, PLA demonstrates much less part warping. For this reason it is possible to successfully print without a heated bed and use more commonly available "Blue" painters tape as a print surface. Ironically, totally removing the heated bed can still allow the plastic to curl up slightly on large parts, though not always.

PLA undergoes more of a phase-change when heated and becomes much more liquid. If actively cooled, much sharper details can be seen on printed corners without the risk of cracking or warp. The increased flow can also lead to stronger binding between layers, improving the strength of the printed part.

Here is a quick reference table of some of the differences between ABS and PLA.

ABS	PLA
Extrude at ~225°C	Extrude at ~180-220°C depending on grade
Requires heated bed	Benefits from heated bed
Works reasonably well without cooling	Benefits greatly from cooling while printing
Adheres best to polyimide tape	Adheres well to a variety of surfaces
Filament tolerances are usually tighter	Finer feature detail possible on a well calibrated machine
Prone to cracking, delamination, and warping	Prone to curling of corners and overhangs
More flexible	More brittle
Can be bonded using adhesives or common solvents (Acetone or MEK)	Can be bonded using adhesives
Fumes are unpleasant in enclosed areas	More pleasant smell when extruded
Oil Based	Plant Based

In Summary

Simplifying the myriad of factors that influence the use of one material over the other, broad strokes draw this comparison.

ABS - Its strength, flexibility, machinability, and higher temperature resistance make it often a preferred plastic for engineers, and professional applications. The hot plastic smell deter some as does the plastics petroleum based origin. The additional requirement of a heated print bed means there are some printers simply incapable of printing ABS with any reliability.

PLA - The wide range of available colors and translucencies and glossy feel often attract those who print for display or small household uses. Many appreciate the plant based origins and prefer the semi-sweet smell over ABS. When properly cooled, PLA seems to have higher maximum printing speeds, lower layer heights, and sharper printed corners. Combining this with low warping on parts make it a popular plastic for home printers, hobbyists, and schools.

Contact Us

on the Sunshine Coast, Queensland www.3dmdd.com.au or email admin@3dmdd.com.au
Phone/Fax 07 5448 5072 Mob 0407 640 827