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Objet Connex500

» Objet has enjoyed much success with its polyjet technology-based rapid prototyping products because of their speed and ability to replicate fine detail. The new Connex500 machine builds on this foundation and adds something no-one else can do - multiple materials in one build. **Al Dean** gets excited

Objet Geometries' rapid prototyping machines have built up quite a following across the globe. The machines are office friendly in the truest sense. You can leave one in the corner of the office and the only real mess is the use of water to remove the support material from your model. The machines are also fast (they can build around 30mm per hour on the fastest settings) and the quality of detail that can be reproduced is excellent. With this strong foundation, where does Objet go next? Into the realms of multiple materials in a single build, that's where.

The PolyJet technology inside Objet's machines has always used a series of print heads which jet both build material and support material at the same time. However, with the Connex500, Objet has added yet more print heads and now it can print with two materials (and a support) at the same time.

By controlling how and where materials are printed to a very fine degree (there are 8 print heads, with 96 jets on each), the Connex500 allows the simultaneous use of two different rigid materials, two flexible materials, one of each type, any combination with transparent materials, or two jets of the same material - you can even combine jets to create materials with new properties. The possiblities are endless.

But let's step back a little and explain how The PolyJet Technology works.

Materials are loaded into the system using closed canisters, so there's very little in terms of raw material handling – you slide the cartridges in and you're ready to do. The print heads can produce very fine layers (down to 16 microns) at very high resolutions – the finest detail capability matches that of a 600dpi printer (the images in this magazine are printed at 300dpi). The print heads allow both build material (a range of photo curable polymers) to be deposited at the same time as support structures (which are water soluble). The end result is a very clean system, that builds layer upon layer, curing each (with UV light) as they go, resulting in models that are very stable straight off the machine and just require running under a tap or water jet to clean away the supports. The last few releases of machine from Objet have seen this process refined and repackaged into a variety of sizes of machine to suit different budgets. Alongside the machine development, Objet has also been developing a range of materials that move from the standard FullCure acrylic material, through to the Vero and tango Materials. These use the same build process to create parts which are task- or application-specific. The Vero materials are intended to replicate production intent materials using a variety of colours and currently include White, Blue and Black.

Meanwhile, the Tango materials allow you to build flexible materials with different shore hardness values. TangoBlack and TangoGray enable a realistic rubber/silicon feel with different Shore A hardnesses. TangoBlack provides high elasticity with hardness of 61 Shore A value, while TangoGray is a slightly harder, but still flexible, material with hardness of 75 Shore A. There's also a new TangoPlus which provides massive elongation at break (over 200%). Within the standard Objet Eden machines, these materials can be swapped out (because of the standardised material cartridges), but you can only build with one at a time.

» Product: Connex 500

» Supplier: Objet Geometries

Price: On application

www.objet.com

1 The same razor model built in different choices of material: in addition to structural performance, material choice is about aesthetics and tactile response. The Connex500 allows users to quickly build multiple design variants, with different material choices to find the best solution or to narrow the choices down, something that has traditionally been very hard to simulate and prototype early in the design process

PART PREP AND BUILD SET UP

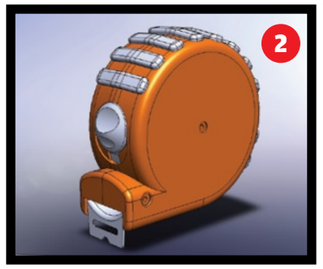
The process you go through to set-up a part which features different materials in a single build is obviously going to differ from the usual RP machine set-up process – the good news is that it's in no way as difficult as you might suspect.

STL files are loaded into the set-up software and material values assigned for each 'body'. Next, you select the materials you want to use. This can be any of the materials currently available, but the really clever bit is in how you can combine two materials to create different variants to achieve the example look and feel you want from your production intent. To explain further, because of the level of control (to per nozzle level), you can create much more than just two materials, as the system can create a wide range of variants by controlling how much of the structure contains one material or the other – these are referred to as Digital Materials.

You select the materials you are using, then select each body from the 3D view window and assign the material you want it built in. If you want the basic material (such as VeroWhite) you simply select that and assign it to that part or body. If you want a specific Shore hardness, you can then go further and choose one of the range of digital materials available. These are selected from a drop down list and are referenced with a Shore A hardness value. The system then knows how much to combine each material into the build to achieve that mechanical behaviour. It really is that simple. You then work through each part or body in your model and assign the material values you need and the system sets it up for you. Once done, you hit print and away it goes.

There are a couple of other tricks or options available. For example, you may want a rigid part (so VeroWhite is a good choice), but you may want a slightly rubberised feel. The set-up studio has the 'coating' option which allow you to define a layer thickness which offsets from the surface of the part and adds a different material as a layer (of your choice), with a lower Shore hardness, to achieve that effect.

It might sound a little complex, but the process is really point and click. The only thing you need to decide on really is what material characteristics you want and where on your model. Perhaps the biggest challenge for using a system like this is actually modelling the part. The good news is that Objet provides you with a wealth of information about what different materials can achieve, and a very handy booklet on how to model your components for the purpose in SolidWorks, Pro/Engineer and Catia.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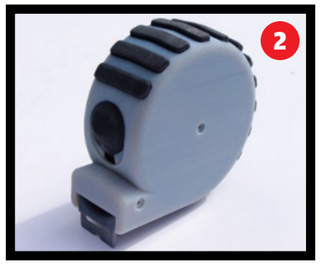
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We had a test model built which we modelled in SolidWorks. It featured several different materials and we really wanted to see how the machine handles replication of over-moulded or dual shot parts – for which the Connex500 is ideal. We built a small tape measurement model with multiple bodies, which were exported as STL files. The model turned out really nicely. It was crisply detailed and well able to withstand handling and testing of mechanisms. (see Figure 2)

CONCLUSION

The Objet Connex500 is a fantastic advance in the state of the art for rapid prototyping. While many RP vendors are now going after the world of direct or rapid manufacturing, developments, the Connex500 shows that the design world can still benefit from advancements in pure prototype production. The process of prototyping dual shot or over-moulded components is a lengthy and drawn out if you use multi-stage silicon moulding to achieve the same effect and is typically reserved for when the design process is near completion and you need production intent samples for focus groups, presentation and such. Until now, there's been no cost effective solution for replicating these types of manufacturing processes at the very early stages of design – when the tactile input and aesthetic qualities really need to be examined most closely. This, for me, is what the Connex500 is all about.

Many are using different combinations of materials to provide products, which are engaging to the consumer, whatever industry or field those products lie within. By using different materials, you can elevate a product's form beyond pure aesthetics and get a different tactile response that people can engage with.

"What the Connex500 offers is a way of simulating design concepts in a cost effective and timely manner where material usage choices can be evaluated as part of the design process"

What the Connex500 offers is a way of simulating design concepts in a cost effective and timely manner where material choices can be evaluated as part of the design process. This lets you try out different material combinations and different form factors in a truly physical sense. That of course, will drive design change because you can adapt your design further based on all the digital design tools we have, backed up with physical prototypes which accurately simulate the products in the real world. And on that basis alone, if you're looking to bring rapid prototyping in-house then it's definitely worth further investigation because the benefits to design, of having this machine ready whenever you need it, can't be overstated. **www.develop3d.com**

2 DEVELOP3D's test design in SolidWorks (top) and model produced in the Connex500 (bottom)

3 Prototyping of large scale components, such as this drill is a snap

4 The Connex500 is slick looking and office friendly and features clean hot swappable material cartridges, standardised print heads and low mess support removal

CONNEX 500 TECH SPECS

- **Machine dimensions** (W x D x H) 1,420mm x 1,120mm x 1,130mm
- **Machine weight:** 500kg. Gross (in crate) 580kg
- **Build envelope:** (X x Y x Z): 500 x 400 x 200mm
- **Layer thickness:** (Z-axis): 16-micron
- **Build resolution:** 600 dpi :42-micron (x and y) 1,600 dpi :16-micron (z)
- **Accuracy:** 0.1 - 0.3mm
- **Support removal:** Water based removal – non toxic gel
- **Materials cartridges:** Four sealed 3.6 kg cartridges
- **Power requirements:** 110 – 240 VAC 50/60 Hz - 1.5 KW single phase
- **No special facility requirements**
- **Jetting heads:** SHR (Single Head Replacement), Eight units
- **Network communication:** LAN - TCP/IP
- **Compatibility:** Windows XP, Windows 2000