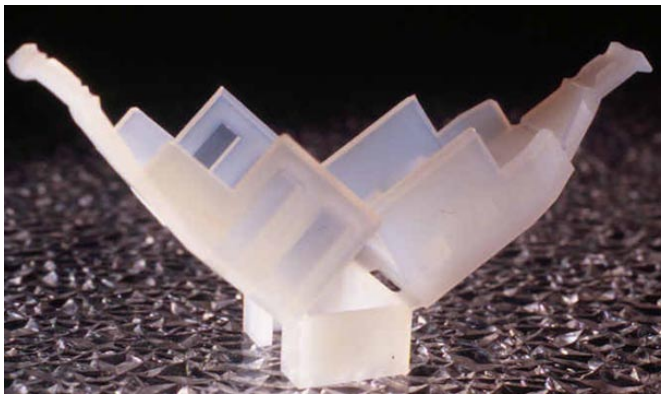
Application Story

Tyco Electronics Now Able to Prototype Living Hinges



Harrisburg, PA (July 20, 2000) - Tyco Electronics (www.tycoelectronics.com), a unit of Tyco International Ltd. and the world's leading supplier of electrical connection devices under the trade name AMP, has been using stereolithography for over a decade at its Harrisburg, PA plant. However, an AMP connector design requirement, which had previously gone unfulfilled for years, was the production of stereolithography parts containing living hinges. Hours of experimentation, coupled with the ProtoFunctional™ characteristics deliverable with the DSM Somos® 8100 resin series, has now enabled the company to achieve stereolithography success.

Bob Zubrickie, Manufacturing Engineer for Tyco Electronics, currently produces about 800 stereolithography parts each month for Tyco Electronics locations worldwide. About 5% of Zubrickie's prototype requests from Tyco Electronics Developmental Engineers need living hinges.

Made completely out of plastic, living hinges often look just like the rest of the plastic part. Instead of having a metal linkage at the point of actuation (such as a door hinge), a living hinge's plastic fibres bend to complete a given motion. A living hinge eliminates the need for more expensive and complicated bending mechanisms, and, as a result, parts can be built ready-to-move, ultimately saving production process time.

"In one evaluated case, Tyco Electronics had been using the Computer Numerical Control (CNC) process to create living hinges for these parts, which took over 50 hours to complete 10 parts, at a cost of $2800," said Zubrickie. "Producing living hinges with stereolithography wasn't possible until DSM Somos® introduced its new 8100 resin series two years ago. DSM seems to be leading the flexible photo resin market where others are trying to play catch up.

"The DSM Somos® 8100 resin series provided the necessary combination of flexibility and rigidity to bring living hinges to life as stereolithography prototypes, because it mimics the mechanical properties of some thermoplastics-often used to make living hinges in production parts," Zubrickie added.

Tyco Electronics used Somos® 8110 to make prototypes of connector housings, which protect many fragile electrical components such as wires, connectors and electrical components. A connector housing is initially in the "open" form so that all of the necessary components can be arranged correctly. Once the components are in place, the connector housing is folded along the living hinge until it is in the "closed" position.

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Application Story

This enables the user to operate the housing with one hand, allowing more efficiency on the job and, in some cases, eliminating the usage of tooling. The connector housing containing the properly placed electrical components is then installed in the appropriate electrical device.

Somos® 8110 significantly reduced production times and costs for prototypes of connector housings," said Zubrickie. "Compared to completing the same number of parts as the CNC process (over 50 hours for 10 parts, at a cost of $2,800), the stereolithography method took under 5 hours at a cost of $260 for 12 pieces." He also noticed that the prototypes produced in the 8110 did not need to go through design reiterations like other prototypes made from other resins. "Somos® 8110 gives a more realistic feel of the plastic to once again mimic the production material," Zubrickie said.

Creating living hinges from stereolithography is a relatively new process, noted Zubrickie, and there are still some limitations involved. Upon experimentation, he found that orientation is critical in the hinge area. In fact, perfecting the method took Zubrickie about eight hours of trial-and-error testing. "Building the hinge in the Z axis improves the strength of that area because it ensures that the hinge will contain many build layers," Zubrickie said. He added that building the hinges in either the X or Y direction creates a score line resulting in premature fracture-causing the hinge to break on its first bend. "When building the hinge in the X or Y direction, I can't even get 15 degrees movement before breakage. Implementing the Z orientation allows me to obtain 90 degree movement-and in one case, I was able to cycle the hinge 12 times," Zubrickie stated.

Due to the chemical composition of the resin, stereolithography living hinges are not as strong as those made from such materials as flexible thermoplastics. Flexible thermoplastics have a linear molecular structure, whereas stereolithography resins have amorphous structures. An amorphous structure can bend, but it is more likely to break than a linear structure. The end result is that a living hinge made with stereolithography will get fewer cycles than the same hinge made from a flexible thermoplastic, and is therefore less reliable. However, Zubrickie noted, using stereolithography saves time and costs in early concepting of the product.

Zubrickie commented that the stereolithography process of creating living hinges is not meant to replace production living hinges or other prototyping methods like CNC that can also make living hinges. Several design iterations can first be made in stereolithography, then proceed to CNC, and then finally put the part into production.

"I'm very pleased with Somos® 8110 capabilities and this particular application has enabled Tyco Electronics to get realistic prototypes to the designers. I've always said 'you're only as good as the tools you are given to do the job,' and this tool is making me look very good! I'm looking forward to experimenting with other 8100 applications and I'm keeping my eye on the latest materials being developed by DSM Somos®," said Zubrickie.