United Sunglass Apparel

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ABOUT

Located between the mountains of northern Utah in the bustling city of Logan you can find a small company that has made large strides. United Sunglass Apparel (U.S.A.) produces patented sunglass retainers, key chains, and wristbands under the retail brand name of TROG. U.S.A. is derived from the former Tek Tool and Plastics, which was a custom injection molding business in Utah. The economic downturn that started in 2007 forced the downsizing and ultimate closure of Tek Tool and Plastics, but ultimately gave birth to a new business opportunity with the creation of United Sunglass Apparel.

The small company with aspirations of success tapped into the eyewear accessories market with a patented design and fresh look. Cody Archibald and Karl Hellberg recently shared with Entegris a project that was completed at U.S.A. using Entegris' POCO materials.

PROJECT

The project was to produce a less expensive alternative to cloth and rope lanyards. Traditional cloth or rope lanyards require labor to assemble and the raw material cost proves difficult to be competitive against the Chinese market. The goal was for a product that could be mass produced without a lot of extra labor to assemble. Injection molding would work but only if the finished part met quality and safety standards and did not look cheap. The material decision was to create the lanyard out of vinyl. According to Karl, "Vinyl provides a competitive cost per pound and yield strength to failure that is right for the product. Thermoplastic polyurethane (TPU) materials were too 'stretchy' before failure. Vinyl material stretched a little and retained its shape, but eventually breaks, which is needed for product safety."

The next step was to create a unique design that would stand out and create interest. The original design idea was a braided rope, but the team members felt this design was plain and they needed something better. During the creative design process many different shapes and layouts were brought forth and discussed. A couple design ideas included stacking bones end to end or replicating a bike chain. With the imagination of the team working overtime, it was soon decided that a barbed wire look was desired. Barbed wire is recognizable from a distance while the others were not as distinguishable. An initial design hurdle to overcome was developing the geometry in order to replicate the barbed wire. The solution that proved most effective was twisting big copper wires together and laser scanning them to create the pattern. This allowed the team to move forward with the barbed wire design.

MILLING

Milling the intricate detail of the barb required a material with flex strength sufficient to hold the sharp point detail and uniform structure for easy machining. EDM-3® graphite was used as the electrode material of choice. "I like to stay in the finer grain materials because I worry less about small bits chipping off when it is being milled," explained Cody. The design of the barbed wire is a bit complex and the version of Mastercam used at the time was a bit older. Processing toolpaths was slow and frustrating at first, but after finding something that worked, the toolpath could be copied over to the later electrodes since they are similar. Using a 3-axis Roku-Roku, the electrodes had to be set on their sides to machine the undercuts. The undersize on the electrodes is 0.020" per side to match some of the undercuts in the part geometry. The finish cut on the electrodes was accomplished using a 0.8 mm ball end mill at the machine's top speed of 15,000 RPM. The longest electrodes are about nine inches long and took about four hours to cut.

EDM

The 420 stainless steel mold was designed to be broken up into multiple sections. There are six different sections for the B side insert and six more unique sections on the A side. The wear performance of the EDM-3 material limited the number of electrodes needed for the job. Each section was done using two electrodes, utilizing one as a rougher and the other for finishing. "The detail is exceptional," stated Karl. The sharp points of the barbed wire were held throughout the burn with minimal wear on the electrodes. It took a little less than 10 hours to finish every burn on the whole insert and the desired surface finish was achieved directly out of the EDM burn without the need for post polishing. The work was performed on a Charmilles Roboform 40 & 30 sinker. Cody commented, "The spherical orbit routine that is built in works just fine with undercut electrodes without breaking them but it only finishes the bottom half of the sphere. The upper areas of the undercuts were left rough." The team reached out to Charmilles Applications personnel to assist with programming to finish the top half of the sphere to achieve the desired outcome.

"My challenge for this project was to make the finished part look clean and perfect. My two main concerns were getting the parting lines on the A and B inserts to be perfectly aligned and also I wanted the seams between electrodes to be invisible," shared Cody. Precision and dialing everything in to create a perfect match between the inserts was the secret to success. Using the C-axis on the Charmilles machines proved valuable for this project. With the length of some of the electrodes, you don't have to be very far off in rotation to move the ends quite a ways, and you don't have to go very far before a seam would be visible.

OUTCOME

With completion of the mold it was now time to start final production on the lanyard. U.S.A. has the capability to design and build the molds, as well as perform injection molding all in house. The lanyard was produced in a single mold on a 65-ton electric Toshiba press with a cycle time of approximately 20 seconds part to part.

As with all new projects, there is a learning curve which includes some trial and error. This project was no exception, but the final result was a lanyard with a unique design that was appealing and sparked interest as a product giveaway. "I learned a lot on this project and have always been extremely happy with how it turned out," expressed Cody. The barbed wire design did not stop with the lanyard project. U.S.A. went commercial with the design and flowed it to other product offerings under the TROG brand name in the form of keychains and bracelets.

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