

PRODUCT FOCUS: REVERSE RP RAMPS UP ACCURACY FOR FIRST-ARTICLE INSPECTIONS



Molders and mold-makers in nearly every market want to add value to the services and products they offer customers. One way to do that is by supplying first-article inspection data to qualify molds. But it's often a double-edged sword, according to family-owned Matrix Tooling, a full-service mold and moldmaker in Wood Dale, IL, because performing this service is a labor-intensive process. By adopting a new automated technology called cross-sectional scanning, based on a reverse of the rapid prototyping process, Matrix found a way to better serve customers and control costs.

In the last five years, Matrix has transitioned into medical molding, adding a Class 100,000 cleanroom and mold-filling analysis at the end of last year. The plant includes 12 presses, with two Toshiba 22-ton electrics in the cleanroom. For the intricate, tight-tolerance tooling on which it focuses, Matrix wanted to bring first-article inspection in-house for greater operational control and to add value. Paul Ziegenhorn, Matrix president, recalls, "Adding first-article inspection seemed to be a good business decision, but to make it work, we needed to reduce the labor hours required."

According to Ziegenhorn, Matrix found a process that delivered more quality control information than traditional inspection tools could provide. Called CSS (cross-sectional scanning), it is a patented in-

Right Color map of an adapter highlights tolerance deviations for quick assessment of first-article quality. Below This CSS system automates the inspection process and eliminates manual sectioning of parts.



spection technology offered by CGI (Eden Prairie, MN).

Gary Johansson, Matrix quality manager, explains, "The CSS system eliminates inspection planning, fixturing, and manual sectioning. When the scanning is complete, I have hundreds of thousands of measurement points that describe every detail of the first article."

Technicians prepare parts to be scanned by potting them in an epoxy material called Encase-It. The potted parts are transferred to the CSS machine, which mills away a thin slice at each pass and scans the milled surface. The scanning software automatically converts the digital bitmap image to edge-detected points as the part is being scanned. Each newly exposed 2D section is scanned

as the process repeats, and algorithms convert the data to a 3D point cloud. For most parts, it takes a few hours for the point geometry to be fully digitized.

Johansson stresses that this automated system eliminates an "inherently flawed" step in the inspection process. "It is a lot of work to pick up a single dimension from a section. We have to make fixtures, cut the part, set it up, and pick off the measurement," he says. "But the more important issue is that sectioning a part reduces the measurement accuracy. We have tried every alternative for cutting parts, and each one results in tearing, melting, or rollover burrs. After cutting, the edges are then hand-worked to clean them up. This changes the dimensions.

In addition, cutting a part is likely to cause distortion since molding stresses are no longer constrained."

Matrix clients routinely call out $-0.000/+0.001$ -inch tolerances, he adds, so cutting a part to reveal a section will introduce error that exceeds these quality specifications. "Since the CSS machine captures all features on all surfaces without distortion, we are able to greatly improve accuracy of the results."

From the hundreds of thousands of measurement points produced by the CSS system, Matrix produces traditional tabular data with nominal dimensions, allowable tolerances, and actual measurements. It also augments the raw data with visual depictions of the measurement results. Says Johansson, "Each measurement is annotated on a section view. For those that pass, the dimension is green. Those that fail are highlighted in red. This allows our customers to visualize the inspection results with just a glance. They don't get this with traditional tools."

From the same 3D point cloud, Matrix can produce vivid 3D images that convey overall part quality. "We are using a color map function in a software program called PolyWorks. In the software, we compare the original CAD data with the inspection data. The output is a color image that highlights the areas that are out of tolerance. Customers are amazed when we present these visual reports."—MM