

Metal Injection Molding Process – Eliminating Metal Particles to Speed-Up Production and Delivery

Metal injection molding is a relatively new process in part forming technology where several key technologies in material science, injection molding, and heated ovens all work together in the same location to produce molded metal parts of various metal properties. Finished parts are sintered to near full density; do not require machining, and meet surface finish and dimensional accuracy requirements not easily obtained with other part forming technologies.

In the injection molding process, high tempered steel molds are used to initially form parts into an uncured (green) state. If any of these parts are partially broken off and left in the cavity during the ejection process, the mold can be severely damaged during the next cycle when the mold closes. The cavity is damaged when the remaining metal particles are crushed together against features in the cavities. Damage can be sufficient in cost depending on the complexity of the mold. In addition, production and delivery goals will be compromised.

Flomet's (a manufacturer of metal injection molded parts) Senior Manufacturing Engineer Walt Hagl says "the multi-cavity molds for the very small, very complex orthodontic parts were being damaged by material remaining in the mold cavities after ejection. We needed a way to know that the cavities were clear prior to allowing the molding machine to proceed with the next cycle. It was not possible for the operators to do this in a reasonable amount of time. The Avalon System has provided us the ability to check each cavity for each mold after every cycle."

Traditional mold protection technologies measure the resistive force of the closing mold as it comes in contact with stuck parts. Injection molding presses commonly reach 150 to 200 tons of clamp closing pressure and while the mold close pressure sensors have been optimized with very advanced controls, it is difficult to compensate for very small changes cycle to cycle in friction, heat, and mechanical displacements without being too sensitive. In addition, these sensors detect forces as they are damaging the mold and many times the injection molding machine cannot reverse direction of the mold before severe damage occurs.

Application

Avalon Vision Solutions (AVS) has over 2,000 systems in North America installed on injection molding machines that prevent mold damage. These systems typically are comprised of an

Advantech touch panel PC that has a Windows XP operation system with Avalon's MoldWatcher machine vision application. In this application, eight USB 2.0 cameras with 50mm lenses are used to capture images on both sides of the mold. Advantech's ADAM 6060 I/O module with custom firmware communicates with the I/O of the press and communicates with the PPC-154 computer via Ethernet cross over cable.



In the MoldWatcher application, reference images are initially stored in the computer's memory and are compared to the process-acquired image each cycle. Image inspections are taken immediately before the ejectors are activated and after they have completed ejecting the parts. If images pass the inspection criteria defined in the process, permission is automatically given to the molding machine to first continue with the ejectors process and then with the mold closing portions of the cycle. If images fail the inspection criteria, the press is automatically stopped, an alarm tower is activated, and an image of the failed cavities is highlighted on the display of the computer. Damage of the mold is prevented because measurements are taken prior to the mechanical movement of ejectors and/or the closing of the mold.

The MoldWatcher product has many process related features that allow adaptability to the changing mold press cycles and use by the operator. In addition, the ability to save jobs, move the system between presses, and mount cameras and lights with magnetic mounts gives the MoldWatcher added value to the injection molder.

Process Rx is a documentation database application that captures images and stores them for later retrieval, animation of stored process images for debugging, and has statistical reporting of the performance of each cavity, molding cycle, and the entire job. The patented camera and light technology used in the MoldWatcher product utilizes near infrared light to eliminate false alarms in the vision inspection process. This works by having a camera that has peak sensitivity in the 850nm range, a light with similar illumination spectrum, and a filter that eliminates light waves in the visible spectrum.

Conclusion

The result of all these computer hardware, software, and optical technologies all combined into one product offering provide for extremely robust, reliable, and affordable technology that is used by non-technical operators. Flomet has saved thousands of dollars in preventing mold damage and preventing lost production. They have implemented Avalon products on several injection molding presses.

Ed Kachnic, President of Avalon, says they have used over 150 PPC computers in the MoldWatcher application and anticipates using other industrialized Advantech computers. The reliability of the Advantech product line has encouraged Avalon to use these computers in their quality control vision inspection applications as well.

Advantech Corporation, eAutomation Group – Founded in 1983, Advantech is a global leading ePlatform service provider integrating web-based technology, computing platforms and customization services that empower the connected eWorld. Advantech cooperates closely with system integrators to enable them in providing complete solutions for a wide array of applications in various industries. Advantech delivers more than a thousand products and solutions under 3 main categories: Embedded & Applied Computing, Industrial and Network Computing, and eAutomation. With the combined talent of more than 2,000 people, Advantech operates an extensive support, sales and marketing network in 16 countries and 28 major cities to deliver fast time-to-market services to our worldwide customers. US operations for the Industrial Automation Group, 1320 Kemper Meadow Drive, Suite 500, Cincinnati, OH 45240. Website for Advantech customers in North America: www.eautomationpro.com/us Email: info@advantech.com

Avalon is a full solution provider of vision applications. The company's product line is designed to run on industry standard Windows XP operating systems. Ruggedized industrial PC's are implemented into real world plant floor applications with hardened cameras and lighting to accommodate the demands created in the manufacturing environment. Exceptionally easy and intuitive interfaces enable shop floor personnel to operate the systems with minimal training. There are **several** application areas the company excels at in implementations. Over 450 plants in North America have in excess of 2,000 systems running in mission critical applications. www.avalonvision.com

Flomet is acknowledged as one of the pioneers in metal injection molding (MIM) technology with over 15 years experience in making quality production components. Flomet's 40,000 square foot facility is located in DeLand, Florida. With engineering, mixing, molding, debinding, sintering, secondary operations and quality assurance all under the same roof, Flomet can offer an integrated solution for your complex miniature component needs. Our technologists, with knowledge gained from decades of MIM production experience, will successfully tackle the most challenging applications. www.flomet.com