

User Case Study for CAM-TOOL

As expected, CAM-TOOL can also be applied to 5-axis machining.

~ Unification of our systems by the trusted CAM has become the key to efficiency ~

Nagoya Precision Mold Co., Ltd.

Since its establishment back in 1975, our client, Nagoya Precision Mold Co., Ltd., has been engaged in the beginning-to-end processes from the designing to the manufacturing of molds for plastic injection molding, and has been expanding its business globally. They have not only their domestic bases: the headquarter that doubles as their main plant in Aichi Prefecture, the Kumamoto plant and Miyazaki plant in Kyushu, but also overseas bases in 2 countries: Vietnam and Indonesia. By placing bases around the world, the company quickly gathers information for products such as car headlights, also known as the face of a car, or combination lamps, indeed a remarkable technological innovation, and then develops cutting-edge mold manufacturing technology in-house to realize fast and high quality mold-making. They installed CAM-TOOL Simultaneous 5-Axis CAM Modules in 2013. Significant results in reducing lead time have been achieved since they started fully-fledged mold manufacturing by using 5-axis machining. Today, let's hear from Mr. Goto, manufacturing director; Mr. Sonoda, manager of the design division at the Miyazaki plant; and Mr. Kamata, system design staff of the design division at the Kumamoto plant.



Kumamoto Plant



Miyazaki Plant



Mr. Goto
Manufacturing Director

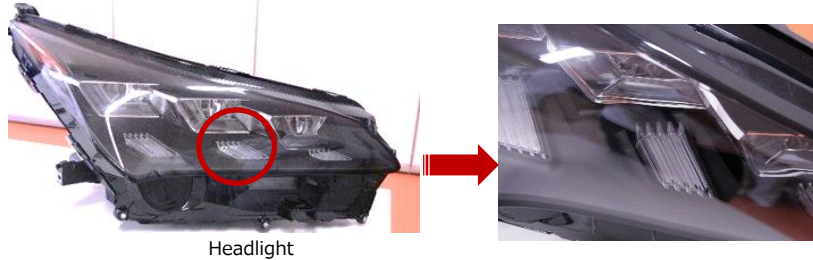
➤ About Handling Molds

Mr. Goto; "We specialize in products related to headlights, working with plastic injection molds for lens, inner lens, reflectors, extensions, light guides, body panels and many other items. As product design evolves, the size of molds tends to increase year by year. The maximum horizontal size of molds has reached about 1.8m, and in terms of weight, we can supply up to 15 tons at the Kumamoto plant, and 10 tons at our main plant and Miyazaki plant. Here we have the facilities that can manufacture molds with various sizes to the extent that is moldable by our 1300-ton-injection molding machine."

➤ Correspondence and Challenge towards Complicated and Sophisticated Molds

Mr. Goto; "As the design evolves, headlights also continue to evolve in a manner so that the light sources are brighter and consume less power. Now LEDs are becoming mainstream light sources. The light radiated by LED needs to be defused in multiple directions because of its characteristic. As a result, the quality demanded on the products is changing, and the molds are also becoming increasingly complicated and sophisticated. If these types of molds were manufactured by only 3-axis machining, deep areas might be required to be processed by longer protrusion tool. But the direct milling has its own limitations, so that creation of electrode and Electrical Discharge Machining (EDM) were indispensable. Moreover, additional man-hours for polishing and other processes caused a number of issues in realizing shorter delivery. That's why we sought a solution in 5-axis machining, and decided to install systems for it. Initially, we used 2 CAM systems separately: CAM-TOOL which we had previously used for 3-axis machining, and another CAM systems for 5-axis machining. However, we found out that not only data convertibility and compatibility difficulties between 2 systems, but also 5-axis toolpaths instability caused additional burdens to our operators. It made our initial goal hard to achieve and we decided to re-consider the 5-axis CAM system.

We compared 4 systems when re-selecting the proper 5-axis CAM for us. We considered that CAM-TOOL might have numerous advantages, such as a high quality surface finishing, stable toolpaths, high usability with various cutting modes and many more, not to mention that it might allow seamless operation between 3-axis and 5-axis functions by a single CAM system, reducing operators' workload. That's why we decided to install CAM-TOOL Simultaneous 5-Axis Module in the Miyazaki plant in 2013, and later on in the Kumamoto plant and main plant in 2014."



Headlight

➤ Drastically Reduce Man-Hours with CAM-TOOL Simultaneous 5-Axis Function

Mr. Sonoda; "Since we were previously using the CAM-TOOL, only about 1 day was required to learn and startup the 5-axis CAM, of which operability was integrated with the 3-axis CAM. In actual operation, since "Z-level Finishing" or other 3-axis data could be easily converted to 5-axis data, not only man-hours for creating data, but also corrective attempts caused by toolpath errors in 5-axis operation, which had been our problem, were drastically decreased. Especially, "Z-level Re-machining" that is detecting remaining area from previous process accurately and quickly, is useful as well in 5-axis operation, contributing to major improvements. Also, since machine simulation function is installed inside the system, it is possible to create the reliable data for machining easily without any data exchange with another simulation software needed before the actual machining.



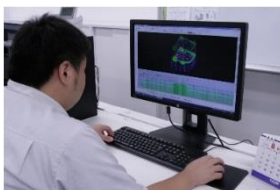
Mr. Kamata
Design Division,
Kumamoto Plant

Mr. Sonoda
Manager of Design Division,
Miyazaki Plant

Because molds are custom single item products, in contrast with mass-produced products, and most of the machining data is created for only one time production, it is important to consider both quickness and quantity in generating machining data. CAM-TOOL made it possible. I think the CAM operation alone has reduced man-hours by 50%. 30% reduction of man-hours in EDM processes, which was our previous challenge, has been also achieved. Depending on mold types, there are even some cases of which EDM process is no longer necessary at all. In addition, since the precision of finished surfaces is improving, the polishing time is also decreasing.

The design shape of important mold parts, such as nesting or sliding cores, are also performed with 5-axis machining. There is a structural component called "floating-slide", used to perform undercut molding, in the mold for headlight lens. This component requires highly precise surface finishing, for instance, to match the sliding surfaces perfectly. Furthermore, it requires 6-face machining, which means that in 3-axis machining the setup must be changed 6 times. By doing this with 5-axis machining, a single setup could perform 5-face machining, thus allowing drastic decrease in setup man-hours."

Mr. Kamata; "The many functions that reduce the cutting-load available in CAM-TOOL have led to surface quality improvement. When machining concave parts, in which toolpaths run along a sharp edge, using some helpful functions such as [R remain processing] that inserts R corners into sharp edge toolpaths to avoid sudden change in cutting-load or [Variable F rate] that enables feed rate to be adjusted according to cutting-amount, have improved the quality of surface finishing. [Smoothing] of simultaneous 5-axis machining, which changes the tool vector gently to suppress any sudden change in tool vector, allows the machine to perform smooth movements, achieving the surface finishing quality improvement too. In addition, by performing simultaneous 5-axis machining for deep cutting areas, it has been possible to shorten tool protrusion length, improving machining conditions and time.



"I prefer using [Surface Finishing] mode for the finishing processes" says Mr. Kamata.

Recently, we have started to utilize "Multi Solid" recently added in the latest "V13.1". By being able to represent stock with a shape much closer to the machining model, the toolpath output precision for unmachined areas has become better and air-cut toolpaths have decreased. We feel that has brought us a profit, and are also expecting further efficiency improvements since we can create stock models containing undercut portions."

Mr. Goto; "Upgrading to 5-axis not only reduces man-hours for setup, but also successfully shifts manual, attended operation to automated operation. It resulted in providing many cost saving benefits. Again, the stable toolpaths of CAM-TOOL became the key that supports automated operation, not to mention its reliable data as well. In addition, the size of molds for headlight parts are large, and $\Phi 80$ -tipped tools are used in their roughing process. Among those molds, molds for parts such as reflectors that diffuses LED light, or light guides that uniformly reflect light source in another direction require complex lens cutting in order to improve visibility. For these molds, 5-axis machining using a R0.1 ball endmill is performed. This process could also be realized thanks to CAM-TOOL, which inherited the precision of 3-axis machining."



Reflective lens by fine machining

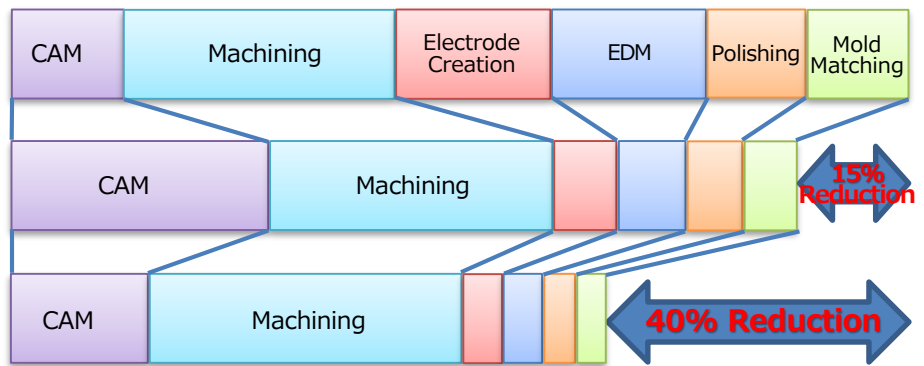
➤ Improved in Lead Time

Mr. Goto; "For these types of molds, by enabling a single-system for mold production that requires a wide variety of cutting tool diameters for each mold, the lead time has been greatly shortened and in this way the cutting tool cost has also been reduced thanks to extended tool life."

3-axis machining
by CAM-TOOL

3-axis machining
by CAM-TOOL
+ 5-axis machining
by other CAM system

3-axis & 5-axis machining
by CAM-TOOL



※ By installing CAM-TOOL simultaneous 5-axis module, CAM man-hours decrease, the utilization rate of 5-axis machining increases, and post-processing require less time.

➤ The Strengths of Nagoya Precision Mold

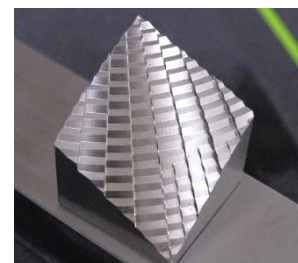
Mr. Goto; "Various technologies are required to accurately machine the design model of molds for headlights. In addition to accumulating technical capabilities for a long time, what we, Nagoya Precision Mold, do care about is to obtain new information. We exercise ingenuity in order to realize the new technology, and we also cherish the courage to speak out about suggestions to each other, which motivates our employees to share their own ideas in order to provide solutions. Moreover, the courage to put ideas forward is essential in order to improve technical capabilities that produce molds. Even though automation technology is increasing, we understand it is important to unify old and new ideas since the fundamental parts of the technology still requires human input as its core element.

In addition, we take the concept of "Self-Contained Production" as our core policy, in which every division involved the production is responsible for checking the quality before delivering to the next manufacturing step. Finally, we, Nagoya Precision Mold, have an inter-process guarantee motto: "Every next process is always for the customer" embedded in our minds to definitely provide our customers the products that have satisfied with our quality standards. In order to achieve that purpose, we believe that the most important thing is cooperation among each division, and we tirelessly put a lot of effort to share useful information across all divisions involved.

Here in the main plant in Nagoya, we do our best every day, working on research and development, performing fine machining for molds intended for super mirrors with high transparency and no distortion, or molds for non-polishing purposes. We are also involved in developing injection molding technology intended for manufacturing molded plastic products that are large and have thin-walls, as a member of an "Industrial Supporting Operation" sponsored by a government organization."



Newly-relocated Kumamoto Plant after the earthquake disaster. Carefully- and thoroughly-considered layout will raise the efficiency even further.



Fine Machining Research

➤ Future Goals and Prospects

Mr. Kamata; "Here in the Kumamoto plant, our goal is to improve machining precision and surface finishing quality even more."

Mr. Sonoda; "By next September, a 5-axis machining center, D800Z by Makino Milling Machine Co., Ltd., will be installed here at the Miyazaki plant. With this installation as an opportunity, we will aim to improve the machining precision and efficiency even further, by considering to change the tooling materials to more rigid ones than the current. We also want to increase the utilization rate of 5-axis machining."

Mr. Goto; "We are aiming to expand and nurture "One Chucking for One Base (No Re-setup)", and continue to improve precision and efficiency even further and set a goal to reduce lead time by at least 30%. While inheriting current technologies, we are also working on research and development. In order to deal with this endlessly-changing time in the midst of new-and-old-fusion, we utilize the area of expertise of each plant: Miyazaki plant's multicolor molding and Kumamoto plant's fine machining. We continue to enhance our competitive technical capabilities and will exert our utmost effort to achieve even better results."

Thank you for your cooperation and time for the interview.



Nagoya Precision Mold Co., Ltd.
Design, Manufacture of Molds for Plastic Injection Parts

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