



[Special Report]
Mold Manufacturing by NARA M TECH

Expanding from Mobile Phone Business to Automobile Business,

Contributing to the Development and Mass Production of Precision Function Parts by Automation Technology for Mold Manufacturing

~ Utilizing the Latest Machining Technology of CAM-TOOL and Supporting Power of IGPNET ~

A Korean manufacturer NARA M TECH, located in Pyeongteak-si, Gyeonggi-do, is a mold manufacturer that supplies leading product and part manufacturers like LG Electronics or Hyundai Motor Company with precise injection molds. They have an injection molding factory, located in Chungcheongbuk-do, Cheongwon-gun, and some parts are molded here. The most outstanding feature of the company is the thorough automatization of mold manufacturing. In the factory, seven robots are operating, in conjunction with machining centers (MC) and Electric Discharge Machines, manufacturing molds day and night. They say that the monthly average operating hours of machining facilities is over 600 hours. Just lately, they have also started part machining by 5-axis MC, and to run automatization smoothly, have been tackling it with the construction of a new machining database (DB).

Founded as a Manufacturer of Precision Molds for Mobile Phone Parts

NARA M TECH was co-founded in 2005 by NARA MOLD & DIE (NARA M&D) and LG



Mr. Kim Chul-Joo

Electronics. The aim of this co-foundation was to manufacture and provide LG Electronics with high quality molds for its mobile phones, including a quick delivery. At that time, LG Electronics would buy molds for its mobile phones from multiple manufacturers. As they procured additional molds to expand manufacturing popular products, from each manufacturer, the difference in quality in each mold was becoming prominent.



Mr. Lee Jong-Joo

Qualitative improvement of molds is indispensable to accelerate products' competitiveness. So they changed the direction to self-manufacturing of molds. Still, they were a newcomer to mold manufacturing. To distinguish themselves from other manufacturers, NARA M TECH aimed to automatize mold manufacturing. The parent company of NARA M TECH, NARA M&D, was founded in 1999 as the mold factory spin off of LG Electronics. Mr. Kim Chul-Joo, who is in charge of business management and Mr. Lee Jong-Joo, who is the mold production team leader at NARA M TECH, have been engaged in mold manufacturing at LG Electronics and NARA M&D.

"The idea to make NARA M TECH an automated manufacturing factory for molds for mobile phones had been on our minds two years before the foundation," says Mr. Kim. Mr. Kim and other engineers who had to be relocated to NARA M TECH have received training at a Japanese manufacturer, FUJI-SEIKO, located in Ota-city, Gunma. FUJI-SEIKO was the technical cooperater of LG Electronics as well as a procurer. The Engineers were sent to FUJI-SEIKO, to learn the latest technology of molds for mobile phones.

As to the development of the automated system, they gave multiple CAM software makers and vendors the same 3D model data and asked each of them to make their own machining data. They then gave that machining data to multiple machining tool makers to get their machining samples and evaluate them. After checking machining precision, machining time, machining quality, etc., they decided the combination of C&G Systems' "CAM-TOOL" and Makino Milling Machine's MC as the best.

Construction of Automated System by Teamwork

"We appreciated the smoothness of the machined surface and the stability of the tool path," recalls Mr. Lee. If the machining precision is bad or

the tools often break, a great deal of manpower is required to recover or restart and that is not efficient. It is the indispensable basic condition that high precision and stable machining data should be output.

CAM-TOOL is able to create high quality finished surfaces by calculating the tool path directly on the surface. Triangulation Mesh (or Polygon) surfaces, are created by other CAM Systems, but are much less accurate representations of the model shape. In these other CAM Systems, the tool path calculation does not have the tool touching the actual surface. CAM-TOOL's surface based calculation ensures a perfectly accurate tool path.

Also, stabilizing cutting loads is an important element to improve machining quality and efficiency. CAM-TOOL is equipped with various functions to control sudden load changes to the tools which causes the degradation of the surface, like cutter marks and damage to the tools.

Indeed, there is another reason to have chosen CAM-TOOL: IGPNET, which works as the sales agent of CAM-TOOL in Korea. Mr. Cha Eui-Chang, the Representative Director of the company, used to be an engineer at Graphic Products, one of the former Companies that merged to become of C&G Systems. Therefore, the company's strengths include its ability to make technical proposals, and abilities to consult with clients about machining improvement, automatization of machining, introduction of 5-axis machining, and so forth. "To construct facilities and processes for automatization, we needed a partner who could support us in technological aspects. IGPNET is the company that has a high machining technology and can tackle problems with us to obtain solutions," says Mr. Kim.

To accelerate automatization, it was important to understand that the experience and skills that each mold manufacturer had acquired so far was not necessarily a benefit. The focus of automatization is not individual technology or skills but how to create and share DB by standardizing machining conditions and tools to use according to



CAM-TOOL is the essence of automatization.



Automatization of Mold Machining using Robots.
Seven robots by EROWA are at work.



work piece shapes, materials, etc. “So we gave up the old ways and customs, and proceeded with environmental enhancements for automatization, in cooperation with IGPNET,” recalls Mr. Lee.

Spirit of Automatization: Machining Data created using CAM-TOOL

Currently, there are 54 employees at NARA M TECH Pyeongteak factory. In the mold manufacturing field, there are 10 designers, eight in charge of CAM, eight in charge of cutting and machining, two in charge of electric discharge machining, eight in charge of assembling, one in charge of injection trials, and two in charge of measuring. They own two 5-axis machining centers (by YAMAZAKI MAZAK CORPORATION and Makino Milling Machine Co., Ltd.), eight high speed machining centers (V33, V 22, and so on by Makino Milling Machine Co., Ltd.), five middle high speed machining centers that process mold bases, six EDM, four wire EDM, and so on. There are seven robots all made by EROWA.

The process of their mold manufacturing is to create the tool path by automated CAM. This process is based on the machining DB (standardized DB, automated DB, and template DB) of the clients' products models, after doing the 3D mold designing and resin flow analysis of models. For example, if previously tools and machining conditions used for the size and depth of each form are decided and the arithmetic operations for each process like roughing, re-machining, and finishing are done, the tool path will be automatically output. “Since everything including interference check and overcut check are done here, we can get safe machining data,” says Mr. Lee. Machining data is forwarded to the machining center through the automated management system server.

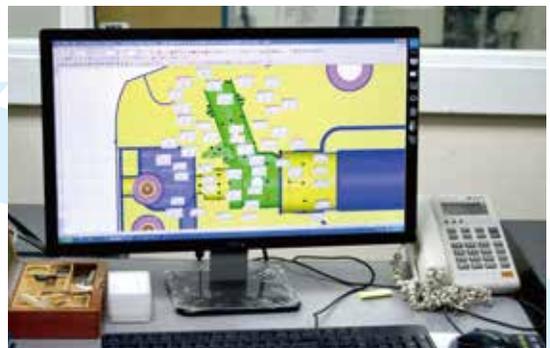
Four and three robots are equipped to high speed machining centers and EDMs respectively. So if they set the work pieces and

electrodes on the palettes and magazines in advance, they can get automatic machining including the exchanging of work pieces and automatic EDM with the exchanging of electrodes by the directed order from PC. In machining of electrodes, they can store 250 pieces of electrode materials so that they can accomplish 3 days of automatic machining.

At this time, in process measurement has become much more important. As the clients' request for quality is increasing such as the guarantee of $\pm 5 \mu\text{m}$ of mold machining measurement precision must be guaranteed. The company checks every machining portion of all the cores they machined. “So far we have been machining products using the tool path output automatically, and the products' precision rate has achieved now 95%,” says Mr. Lee. Thus, by measuring all machining parts, they aim to achieve the 100% precision rate.

Shifting to the Automobile Field, Getting Clients and Contributing Mass Production

The company was originally founded as a mold factory for mobile phones. However, as the amount of development of mobile phones and its molds are getting decreased year by year, their



All machined parts are measured individually, for Quality Control.

business has recently been shifted to the automotive industry. Currently, the sales amount of molds for automobile parts accounts for 50% of the business. NARA M&D also manufactures molds for automobiles, but while it deals with big sized molded items like 350~450t, NARA M TECH handles small sized high precision ones, and that way they have been able to coexist.

In 2015, the company got an SQ Certification (Partner Quality Certification) of Hyundai Motor Company and started direct business with them. The reason for the certification is because they realized the domestication of manufacturing of solenoid valves for automobile engines and insert injection molds for injectors of fuel injection equipment of engines which used to be manufactured in Germany.

As for injectors, there are six $\phi 0.358\text{mm}$ holes for nozzles on each, and as well as they do this

part's drilling they also handle the machining of the pipe parts. These are done by 5-axis MC and they plan to automatize them in future. "With the support from IGPNET, we are going to promote the conversion of machining DB from current machining mainly focused on small parts to the machining optimized for 5-axis machining and middle size machining," Mr. Lee emphasized.

"From now on we are going to strengthen the sales with European and Japanese automobile parts manufacturers," said Mr. Lee. He pointed out as indispensable the task of strengthening the partnership between NARA M&D, further accumulation of precision machining technology and 5-axis machining technology, practice of synergy with injection factories, and promotion of manpower training. He is quite ready to expand their business.



The Injector Used for Fuel Injection Equipment
There are 6 $\phi 0.358\text{mm}$ holes for nozzles at the top.



Solenoid valve for automobile engines
The company succeeded in domestic manufacturing of insert injection molds.

With Its Strong Technological Proposal



*Mr. Cha Eui-Chang,
the Representative Director*

IGPNET was founded by Mr. Cha Eui-Chang in 2000, after his experience as the representative director at the Seoul office of Graphic Products. The company is not only the general agent of CAM-TOOL but also deals with products by ELYSIUM JAPAN, MST Corporation, Mitsubishi Material, and DIJET; and can handle technological proposals and consultation, from creating 3D data to tool path outputting by CAM, and machining. There are 17 employees: 10 in charge of engineering, four in charge of sales, and three in charge of management and administration.

Their clients are around 500 companies including such leading companies as LG Electronics, Samsung Electronics, Hyundai Motor Company, and so on.

IGPNET KOREA

*Mr. Jung Gyun-Yong,
the Sales Manager*

Mr. Jung Gyun-Yong, the Sales Director, is responsible for IGPNET's sales. His clients are mainly die casting or forging die manufacturers. In near future, he will focus on precision mold manufacturers that creates LED or lens molds. He keeps in mind to explore the tasks, earning his clients' trust. The team members band together and tackle the tasks with the same commitment.



*Mr. Jang Young-Jun,
the Team Manager*

Mr. Jang Young-Jun, the team manager, is responsible for engineering at IGPNET. He especially deals with machining consultation for leading company clients. He was also engaged in the construction of the automatization system of NARA M TECH. He is currently engaged in technical proposals for 5-axis machining. As the manager, he works at improvement of all technical member's skills.

