

The State of the Art in Manufacturing and Precision Engineering of Korea

- National R&D Perspective -

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For the time being, R&D investments of Korean government are aiming at the areas where the sustainable manufacturing is required, which private sectors could not afford, and which is the emerging technology, but too risky for the private sectors. In this lecture, from this kind of viewpoints, I presented our current R&D efforts in Manufacturing and Precision Engineering by introducing 3 national R&D ongoing projects related to them as examples; Microfactory for less energy and material consumption, i-Manufacturing for collaborative works, and Nanomechanics and Nanomanufacturing Projects for emerging technology.

1. Introduction

In the process of Korea's economic development, science and technology has been a strong engine. The level of our science and technology has been improved through intensive R&D investments by the Korean government and private sectors. Our R&D expenditure has grown rapidly, and Korea is now among the OECD leaders in terms of R&D intensity. (Fig. 1)

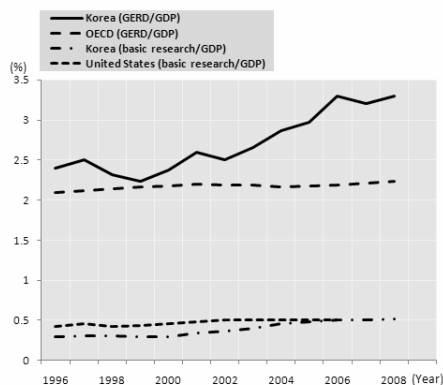


Fig.1 Gross expenditure on R&D and basic research, 1996-2008

At the early stage, Korean government initiated the R&D investment needed for industrial and socio-economic development. However, recently the industry has now taken over increasing roles in fulfilling technological demands along with the rapid expansion of technological abilities. Business enterprises account for most of the R&D expenditure, financing almost two thirds of total R&D budget. The dominance of the business sector in R&D, with its natural emphasis on development rather than on basic research, has led the government to increase its spending on R&D and to set targets designed to increase basic research. R&D investments of Korean government are aiming at the areas in which the sustainable manufacturing is required, which private sectors could not afford, and which is the emerging technology,

but it is too risky for the private sectors. From this kind of viewpoints, I would like to present our current R&D efforts in Manufacturing and Precision Engineering by introducing 3 National ongoing R&D projects related to them, those are Microfactory, i-Manufacturing, and Nanomechanics and Manufacturing.

2. Microfactory

In Korea, Microfactory project has been initiated as a National R&D project in 2004. It consists of 3 phases. The title of the 1st phase (2004~2007) was 'Development of Core Machine Element Technology'. In this phase, precision components for micromachines were developed to construct a Microfactory. The title of the 2nd phase (2007~2009) was 'Development of Unit Machine System and Microfactory Construction for Field Applications'. In this phase, unit machines were developed, and two Microfactories for BT and IT industries were constructed by the use of developed unit machines.

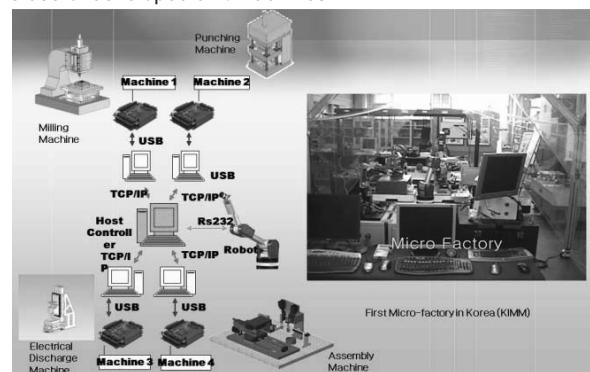


Fig.2 First Microfactory in Korea

It is now in its 3rd phase (2009~2011) with the title of 'Micro-factory for Future High Tech Industry'. In this phase, a Microfactory for microimage sensors will be developed. Throughout the phases, 9 industries, 15 universities, 3 research institutes, and 6 foreign organizations has been participating in

the project. In this coming October, the 7th International Workshop on Microfactories 2010 (IWMF) will be held in Daeduk Science Park of Korea.

3. i-Manufacturing

In order to survive in the present industrial environment, large enterprises producing finished products should focus on the more crucial stages in product development cycle, like R&D or product design. Most of the general manufacturing stages, like mold fabrication and part manufacturing, are conducted by the collaborating companies. But, most collaborating companies are small-scale with low level manufacturing technology.

In Korea, the mold makers are small-scale and struggling to meet their customers' requirements. Large enterprises want collaborating companies to invest in man-power, equipments and software. However, small companies cannot afford to do it. Even worse, another difficult problem is to hire and keep the experienced engineers and skilled workers in mold making. In order to cope with this problem, an engineering collaboration model among the parties was suggested. That was i-Manufacturing project initiated in 2004. It is a system methodology enabling the integration of manufacturing operations and functional objectives of an enterprise by using information technologies (e.g., the Internet, and tether-free communication methods including wireless networking or web-based connections)

The engineering collaboration hub was being constructed from 2005 in a step by step manner and numerous collaborations were executed.

- Collaboration hub systems for
 - designing injection molds : Design_Hub
 - designing blow-product molds : Blow_Hub
 - producing injection molds : Production_Hub
 - engineering collaboration : Engineering_Hub
 - styling and developing automobile parts : Automold_Hub

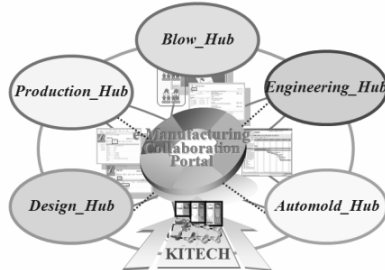


Fig.3 Collaboration Hub Systems Developed

Through these collaborations, the number of molding trials was reduced, and the cost reduction was achieved along with the faster deliveries and less resin consumption.

4. Nanomechatronics and Manufacturing

Nanomechatronics and Manufacturing project has been initiated to study the basic science of nanoscale process and develop technologies and equipments required for the nanoscale manufacturing in 2003.

In the nanomanufacturing part, nanoimprinting and nanoinjection molding processes are being studied. In the nanoequipment part, UV-NIL tools and large area mask pattern

tools are being developed. In the metrology, measurement and analysis part, nanoscale measurement, reliability, analysis and simulation are being studied. Various nanoscale manufacturing equipments are being developed. Their application results are presented in Fig.4.

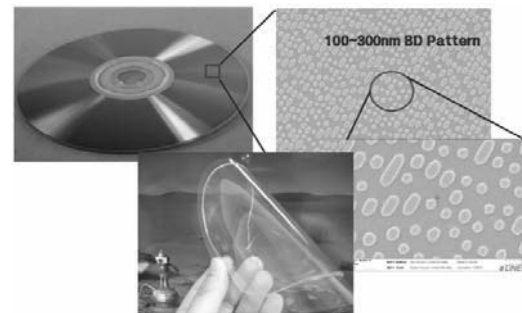


Fig.4 NIL Results : Blu-ray Disc

5. Conclusions

Korean government is trying to encourage and stimulate its R&D parties like national institutes, academia and/or industries through R&D investment and evaluation process despite of the controversial issues remaining for its effectiveness. For the time being, R&D investments of Korean government has been focusing on the area in which the sustainable manufacturing is required, the area which private sectors could not afford, and the area which is the emerging technology, but it is too risky for the private sectors. In this lecture, the three national ongoing R&D projects of Korea are presented as examples of the state of the art in Manufacturing and Precision Engineering of Korea.

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