技術資料

# Present Situation of Education and Research on Foundry Engineering in Japan

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## 1. Departments dealing with metallurgical engineering in university

Making products is a basic activity of all fields of industries. It is impossible to achieve the enduring development of economy without the progress of its production technology. Only the strenuous modification of advanced materials technology can stimulate technological innovation. Foundry is one of principal production technologies. For the sake of the further development of foundry technology, young researcher, technologist and technician are greatly expected not only to take over the conventional technologies but also to progress those further by their own characteristic ideas. However, because of the long lasting business depression, uncomfortable working surroundings in foundries and dull impression for its non-finalized products, most of young people have avoided getting a job in foundry industry. Therefore, it is widely worried that the succession of uniquely developed Japanese-style foundry technology, in which high values of quality have been added as the result of its iterative modification, becomes quite difficult in the near future. All of few births, decreased population of the employed, factory transfer to the rest of the world and less interest in making products by many children are potential fears for the future of foundry industry.

In Japanese universities, the departments dealing with metallurgical engineering have significantly contributed to the development of foundry technology, which is one of typical representatives of making-products. Another important role of university is to supply graduates to production industries as young researchers and technologists. More than 15 years ago many of graduates from the departments of metallurgy, metallurgical engineering (e.g. the department of metals, metallic materials, metal-working or ferrous metallurgy) got employment in industries of foundry. However, nowadays there are very few graduates to work at foundry industry even though they have a good knowledge of raw materials in foundry industry.

Research topics mostly interesting university of science and engineering have been concentrated to the fields of advanced technologies such as electronics, information-technology, robotics and bio-technology. In the field of metallurgy, furthermore, physical property and nano-technology are keywords to extract research funds most probably. Such a preference of advanced technologies by researchers resulted in the quite limited number of laboratories dealing with foundry technology. The organizational reformation of departments in university and/or graduate school aggravates the situation of foundry engineering further. At present the number of departments having a word of "Metallurgy" within their name are only 3 in all of universities, having decreased from approximately 40 in the past. A great variety of names were utilized for newly established departments; e.g. the departments of materials science and engineering, materials property science, materials property engineering, functional materials engineering, materials design engineering, materials working, materials processing, quantum engineering, substances science, substances engineering, substances design engineering, substances control engineering, functional substances science, intelligent functional creation engineering, intelligent production systems,

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production engineering, mechanical systems, applied energy science and so on. Note that the names of newly established departments can hardly bring the correct images of their actual activities to high-school students who wish to enter.

The unification and closure of departments urged not only to change their name and research topics in laboratories dealing with foundry but also to decrease the number of lectures on foundry technology. In fact, the newly established departments tend to treat the studies on foundry and smelt quite lightly by regarding those as examples of a generation ago. Only a few lectures on ferrous materials, non-ferrous materials and structural materials briefly touch on the foundry, in addition to lectures on metallurgical working in which the fabrication procedure of foundries has been slightly introduced to students. As a result of such an organizational reformation, research projects and researchers dealing with foundry technology are gradually decreasing in size. Similar organizational reformations at national college of technology and national research institute also decreased the number of laboratories dealing with foundry technology because of its out-of-fashioned images.

In order to remain the education and research on foundry engineering as necessities of making products, it is quite important for young researchers and students to be interested in its more sophisticated research style, in which all metallurgical events such as melting, casting, solidification and molding are regarded as fundamental phenomena of physics or chemistry and the use of advanced analytical instruments and computers is a matter of course for their research motivation. And also, the promotion of the details of metallurgical engineering and foundry engineering is important to freshmen in universities and high-school students.

## 2. Personnel constitution of Japan Foundry Engineering Society

The number of members of Japan Foundry Engineering Society is approximately 3000 in the year 2000, having gradually decreased year by year. Nine percent of those are researchers from universities and high-schools of technology, whereas 4.5% from national research institutes. There are about 120 student members, among whom less than 10% will remain in the membership after their graduation statistically. Therefore, the present situation is like researchers from universities, schools and institutes to rarely participate in the Society. As for the age distribution of members, furthermore, those aged between 50 and 65 comprise a large part of the total participants as their generation similarly monopolized 30 years ago. This is a natural result of little participation of young people in the Society.

Research results of members are represented at annual meetings of Japan Foundry Engineering Society in spring and autumn. The meeting held in October in 2000, for example, had totally 122 talks as usual; i.e. 60 by 26 universities and high-schools of technology, 17 by 8 national research institutes and 22 by the collaboration between universities and companies. Note that research projects mainly conducted by university or high school of technology exceed a half of the total number of talks. This suggests that research activities of foundry engineering in university and high-school of technology are still vital because one laboratory has 1 to 4 talks on average. However, most of research leaders in these laboratories are 50s and 60s in age. By adjusting research surroundings to the present situation, therefore, it is strongly expected that the same research activity will be kept in the future. Japan Foundry Engineering Society is tackling a problem of how to create more attractive society for young researcher and technologist by expanding its framework of research, technology and industry of foundry.

## 3. Education and training on foundry technology

As for the education and training on foundry technology, only a few academic and industrial groups including Japan Foundry Engineering Society are organizing seminars temporarily. Only the Materials Process Technology Center Foundation (SOKEIZAI Center) regularly holds a series of seminars on foundry production technology for technologists and technicians

at companies every year. These seminars titled "Practical technique on production engineering" are especially arranged for those who have experience in business for 3 to 15 years at their company. The available topics are "High pressure casting and forging of aluminum alloys", "manufacture of aluminum alloy castings", "manufacture of aluminum pressure diecastings", "manufacture of cast iron", "manufacture of cast steels", "manufacture of copper alloys", "preparation of molds", "computer simulation of solidification and melt-flow", "preparation of permanent molds for aluminum pressure diecasting and plastic injection forming" and so on. These seminars, whose speakers are mostly members of Japan Foundry Engineering Society, cover a wide range of metallurgical fields; e.g. foundry materials, melting, casting, cast design, molding, casting instruments, quality control and computer simulation, in 3 to 5 days. The number of participants is usually 250 to 300 in total, of course, although it depends on the topics and annual situation.

The Ministry of Labor is also organizing the qualifying examination for foundry technicians. One of three grades of qualification for melting and molding technicians of castings is awarded as their results of written and practical examinations.

## 4. Final remarks

In order to cope with the progress and territorial expansion of materials science and technology, the organizational reformation of departments has been performed in all Japanese universities. One of the purposes is to raise the quality of students. The desirable person for newly established departments is expected to be;

those who have a wide range of special knowledge from physical property, processing and recycling to law in order to judge and satisfy the demands of our society,

those who have an ability to set up appropriate questions for a difficult problem and to solve those quite creatively,

those who can develop not only materials but also their production systems,

those who have not only special knowledge in a number of fields among physical property, processing and exploitation but also an ability of those application,

those who can offer the information on materials to customers and societies in easier terms.

For that purpose, the departments and laboratories having a word of "metallurgy" or "metals" within their name have been replaced by new ones having a word of "materials" or "substances" because of their old-fashioned images. Therefore, it is quite natural that the newly established departments are expected not only to deal with various non-metallic materials including polymer and ceramics in their research and lecture but also to take over the fundamental roles played by conventional departments for all fields of industries. Note that the organizational reformation should be performed in deep consideration of the future of education and research systems, not in pursuit of the novelty and trend of advanced materials. A balance of the pursuit of advanced technology and the succession of conventional technology is also quite important.