Education and research in Center for Membrane and Film Technology and Research Organization for Membrane and Film Technology

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Abstract

Previous co-operations between Industry and University were mainly focused on the research activity. New type of framework is established in Kobe University for the purpose of the co-operation on the engineering education as well as the research. We established Center for Membrane and Film Technology (CMFT) in Kobe University on April 2007. This is the first membrane center in Japan. The mutual exchanges between CMFT in Kobe university and the membrane centers in foreign countries bring about the good experience to students and thus are very effective in the education. Besides CMFT, Research Organization for Membrane and Film Technology (ROMFT) was established on July 2007. The mission of ROMFT is to bridge the industry and CMFT together. ROMFT encourage the students in CMFT to attend the international meeting and to stay in the foreign membrane center through the financial support. In addition, co-operation between industry and CMFT is progressing on both education and research fields in the support of ROMFT.

Keywords: Center for membrane and Film Technology, Research Organization for Membrane and Film Technology

1. Center for Membrane and Film Technology (CMFT)

The membrane technology is now growing and applied to various fields such as water treatment, gas environmental protection, electronic device, medical use and so on. Especially, water purification by the membrane has been attracting much attention due to the worldwide water shortage. The CO₂ membrane separation is also the hot topic with respect to the protection of global warming.

We established Center for Membrane and Film Technology (CMFT) in Kobe University on April 2007. The CMFT in Kobe university consists of 14 faculty members and more than 110 students. Four research groups belong to CMFT. That is, Organic Thin Film for Photonics/Electronics Group, Advanced Membrane and Thin Film Catalyst Group, Membrane Separation Group and Film and Membrane Coating group. The organization of CMFT is shown in Fig.1.

In Organic Thin Film for Photonics/Electronics Group, they investigate new process for oriented organic thin films. Research topics in this group are shown in Fig.2. In Advanced Membrane and Thin Film Catalyst Group, research topics are preparation and characterization of membrane and thin film catalyst, molecular

Fig.1 organization of CMFT

Fig.2 Research Topics of Organic Thin Film for Photonics/Electronics Group

sieving catalyst and selective photoreaction over membrane catalyst. The detail in this group is shown in Fig.3. Membrane Separation Group is investigating preparation and structure control of porous membrane via phase separation methods, water treatment of membrane modules and clarification of membrane fouling process and gas separation by facilitated transport membrane. In Film and Membrane Coating group, research topics are dispersion control of suspension, structure control in the coating process and drying of coated film. Research topics in both two groups are shown in Figs. 4 and 5, respectively.

One of the main missions of CMFT is the collaboration with other membrane centers in the world. Last year, four faculty members in CMFT visited to The Center for Membrane Applied Science & Technology (MAST) in Colorado University in USA. According to their Website, MAST was founded in 1990 to conduct research, transfer technology and promote education in membrane technology. The MAST Center is a National Science Foundation Multi-site Industry/University Cooperative Research Center (MUC I/UCRC). The MAST Center has a 12-year track record of innovation, operating efficiency, and broad-based corporate support. At the MAST Center, they designed the center to complement their sponsors' strengths in product development. We learned a lot about how we satisfy our sponsors. Now we are planning to exchange students as well as faculty members in mutual membrane centers. We believe this will be good chance for students to know not only the technology but also the different culture.

As shown in Fig.6, there are several famous membrane centers in the world. For examples, the membrane centers in Institute of European membrane in France, in Tsinghua University in China, in Chung Yuan university in Taiwan and in New South Wales university in Australia. We want to co-operate with these membrane centers.

Advanced Membrane and Thin Film Catalyst Group

Prof. S. Nishiyama, Dr. Y. Ichihashi

Membrane and thin film catalyst

Preparation and evaluation of the mono layer of several oxide catalysts supported on zeolites and mesoporous materials.

Molecular sieving catalyst

Design of molecular sieving catalyst and preparation of noble metal catalyst coated with silica-nano membrane.

Selective photoreaction over membrane catalyst

Selective photoreaction over the photocatalysts supported on membranes and thin film photocatalysts.

Fig.3 Research topics of Advanced Membrane and Thin Film Catalyst Group

Membrane Separation Group

Prof.H.Matsuyama, Ass.Prof.T.Maruyama, Dr.M.Teramoto

Preparation and structure control of porous membrane via phase separation methods

Preparation of hollow fiber porous membranes via thermally induced phase separation (TIPS) and nonsolvent induced phase separation (NIPS).

Water treatment of membrane modules and clarification of membrane fouling process

Research on the membrane fouling process based on water treatment experiment of river water.

Gas separation by facilitated transport membrane

Development of facilitate transport membranes and application to various separation systems (CO₂ separation, Olefin/Paraffin separation and so on)

Fig.4 Research topic of Membrane Separation Group

Film and Membrane Coating Group

Prof. N. Ohmura, Ass. Prof. H. Imakoma, Ass. Prof. H. Suzuki, Dr. Y. Komoda

Dispersion control of suspension

Evaluation and control of the particle dispersion in a suspension with the aid of rheological characteristics.

Structure control in the coating process

Research for the methods to control the structure of particles in a coated film and membrane.

Drying of coated film

Development of measurement method for drying rate of coated film and a new drying model. Investigation of effects of drying methods including microwave on qualities.

Fig.5 Research topics of Film and Membrane Coating Group

Fig.6 International Network

Last year, 4 graduated students in CMFT attended the International Membrane Conference held in Taiwan. They made poster presentation and two students got awards for excellent poster. Fig.7 shows one scene of poster presentation. On the other hand, three professors in the membrane center in Taiwan visited our center. One graduated student in Taiwan membrane center stayed in our center for about 2 weeks and carried out the joint research. These mutual exchanges bring about the good experience to students and thus are very effective in the education.

Fig.7 Poster presentation in Taiwan

2. Research Organization for Membrane and Film Technology (ROMFT)

Besides CMFT, Research Organization for Membrane and Film Technology (ROMFT) was established on July 2007. The mission of ROMFT is to bridge the industry and CMFT together. Now more than 20 companies are the

Fig.8 Relation between CMFT and ROMFT

members of ROMFT. The relation between CMFT and ROMFT is shown in Fig.8

ROMFT encourage the students in CMFT to attend the international meeting and to stay in the foreign membrane center through the financial support. Last year, three students could receive the financial support from ROMFT. They attended the following international meetings.

- 8th International Conference on Chemical and Process Engineering (Italy)
- Korea-Japan Joint Forum 2007 (Korea)
- The 3rd East Asia Symposium on Functional Dyes and Advanced Materials (Korea)

Figure 9 shows snapshots of presentations in respective meetings.

Fig. 9 Snapshots in presentations in International meetings

In addition, ROMFT gives final support to PhD students in CMFT to do the research. Last year one PhD students received the scholarship. The research title was “pH-Responsive Behavior of Hydrogel Microsphere altered by Layer-by-Layer Assembly of Polyelectrolytes”.

Co-operation between industry and CMFT is progressing on both education and research fields in the support of ROMFT. Four researchers were already dispatched from member companies of ROMFT to CMFT. This is the example of co-operation between industry and CMFT in education field.

3. Conclusion

New type of frameworks such as Center for Membrane and Film Technology (CMFT) and Research Organization for Membrane and Film Technology (ROMFT) are established in Kobe University for the purpose of the co-operation on the engineering education as well as the research. For one example of activities, ROMFT encourage the students in CMFT to attend the international meeting and to stay in the foreign membrane center through the financial support. As example of co-operation between industry and CMFT in education field, four researchers are dispatched from member companies of ROMFT and are training in CMFT. Thus new type of education system for researchers in companies as well as students is now progressing.

Biography

EDUCATION

B.A.Sc. (1983), M.A.Sc. (1985), and PhD (1990) in Chemical Engineering, Kyoto University.

PROFESSIONAL EXPERIENCE

1985-94 Assistant Professor, Kyoto Institute of Technology.
1994-98 Lecturer, Okayama University.
1998 Associate Professor, Okayama University.
1998- 2004 Associate Professor, Kyoto Institute of Technology.
2004 Professor, Kobe University
2007 Director of Center for Membrane and Film Technology

PUBLICATIONS: 130 refereed publications plus 3 books

AWARDS

1992 Award of Society of Chemical Engineers of Japan
1997 Award of Membrane Society of Japan
2002 Outstanding paper award of Society of Chemical Engineers of Japan