

***COLLOQUIUM (2015-6)***  
***School of Materials Science & Engineering***

**“Functional Polymer  
Self-Assemblies”**

**Prof. Ree, Moonhor**  
**(Dept. of Chemistry, POSTECH)**

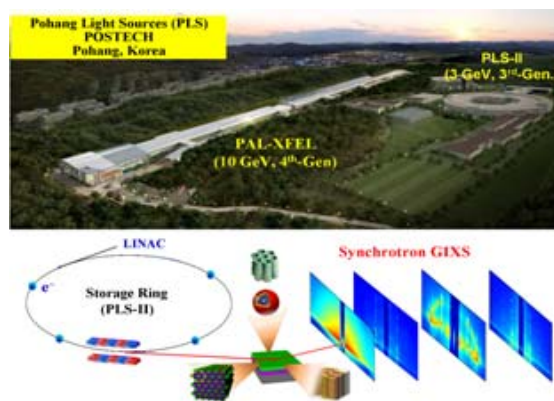
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**APRI 1F, Auditorium Hall**

# Functional Polymer Self-Assemblies

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For advanced functional materials such as biopolymers, bio-mimic polymers, brush polymers, star polymers, dendritic polymers, and block copolymers, information about their surface structures, morphologies, and atomic structures is essential for understanding their properties and investigating their potential applications. Self-assembly characteristics of several functional polymer systems are discussed. They all have been investigated in detail by using synchrotron grazing incidence X-ray scattering (GIXS) and data analysis. GIXS is the most powerful, versatile, and non-destructive tool for determining structural details when is performed with the aid of an advanced 3<sup>rd</sup>-generation synchrotron radiation source with high flux, high energy resolution, energy tunability, and small beam size. One particular merit of this technique is that GIXS data can be obtained facily for material specimens of any size, type or shape. However, GIXS data analysis requires an understanding of GIXS theory and of refraction and reflection effects; furthermore, for any given material specimen the best methods for extracting the form factor and the structure factor from the data need to be established. Moreover, the GIXS technique can significantly improve its structure analysis power by using the new synchrotron radiation sources such as third-generation X-ray sources with picosecond pulses and partial coherence and fourth-generation X-ray laser sources with femtosecond pulses and full coherence.



**Fig. 1** Top image: 3<sup>rd</sup> and 4<sup>th</sup>-Generation synchrotron radiation source facilities (PLS-II and PAL-XFEL) of Pohang Accelerator Laboratory (PAL), POSTECH, Pohang, Korea; bottom image: a schematic setup of synchrotron grazing incidence X-ray scattering (GIXS) and some of the measured GIXS images.

## References

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- 8) K. Kim, H. Kim, T.-H. Kang, M. Ree, "A Study of the Feasibility of Single Molecule Scattering Analysis with X-Ray Free Electron Lasers", *Macromol. Res.*, **22**, 8 (2014).
- 9) *More papers* listed on <http://mree.postech.ac.kr>

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### Education

Sept. 1/1982 - May 23/1987 Ph.D. (Polymer Physics & Chemistry)  
University of Massachusetts, Amherst, MA 01003 USA  
March 2/1977 - Feb.20 /1979 M.S. (Polymer Chemistry)  
Korea Adv. Inst. Sci. Technol. (KAIST), Seoul, Korea  
March 2/1973 - Feb. 25/1977 B.S. (Chemistry)  
Korea University, Seoul, Korea

### Professional Experiences

09/2010 – present POSTECH Fellow  
Pohang University of Sci. & Tech. (POSTECH), Pohang, Korea  
09/2011 – present Science Advisor, Pohang Accelerator Laboratory  
11/2007 – 08/2011 Director of Pohang Accelerator Laboratory  
09/2004 – 10/2007 Deputy Director of Pohang Accelerator Laboratory  
08/1993 – present Professor, Dept. of Chemistry and Division of Advanced Materials Science  
Pohang University of Sci. & Tech. (POSTECH), Pohang, Korea  
09/1988 – 07/1993 Staff Scientist, Advisory Scientist  
IBM Advanced Packaging Lab., Adv. Polym. Sci. Tech. Group  
Hopewell Junction, NY 12533 USA  
04/1987 – 08/1988 Postdoctoral Fellow  
IBM Almaden Research Center, Polymer Sci. & Technology,  
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### Professional Societies

President (2011-2012), Asia/Oceania Forum for Synchrotron Radiation Research  
Vice President (2009-2010), Asia/Oceania Forum for Synchrotron Radiation Research  
Board Member, Korean Synchrotron Radiation Sources Users Association  
Union of International Crystallography Associations  
Polymer Society of Korea: Chair of Daegu-Gyeongbuk Region (2010); Board Memebre  
Korea Chemical Society : President of Macromolecular Chemistry Division (2009)  
Korea Information Display Society  
American Chemical Society  
Americal Physical Society  
American Materials Research Society

### Awards and Honors

National Order of Merit, The President of Korea, 2013  
Taikyue Ree Science Award : The Korean Chemical Society & Taikyue Ree Foundation, 2013  
Toray Polymer Prize : The Polymer Society of Korea, 2012  
Shingeh Science Award : Korea Synchrotron Radiation Users Association and PAL, 2012  
MR-Springer Award : Macromolecular Research & Springer Publisher, 2011  
MBC Sam-II Science & Technology Award : MBC Sam-II Foundation, 2009  
Kyeongbuk Science and Technology Award : Kyeongbuk-do, 2008  
Scientist of the Month Award : Ministry of Education, Science & Technology, 2007  
Sigma-Aldrich Scientist Award : Korean Chemical Society, 2006  
Korean Academy of Science and Technology, Member, elected 2004  
Best Research Paper Award : Polymer Society of Korea, 2004

Best Research Paper Award : Korean Federation of Science and Technology Societies, 2000  
Best of the Best Award (1992) : IBM  
Patent Application Awards : IBM Company, 1989, 1992

### **Research Interests**

Grazing and conventional scattering: X-ray, neutron, and light  
Reflectivity: X-ray, neutron, and light  
X-ray free electron laser science  
Polymer morphology  
Functional brush polymers  
Nonvolatile polymer memory systems  
Shape-memory polymer systems  
Proteins, polynucleic acids, and polysaccharides: structures and functions  
Polymer nanomaterials and nanostructuring and nanopatternings  
Environmentally friendly polymers  
New functional polymer synthesis

### **Achievements**

More than 320 papers in SCI-registered journals  
About 80 proceeding papers  
More than 900 presentations including plenary lectures and invited talks  
More than 100 patents including patent applications  
Accomplished Major upgrade of Pohang Light Source (100 M\$/2009-2011)  
Launched the X-ray Free Electron Laser Project (426 M\$/2011-2015) for advancing Korean Science and Technology in 21<sup>st</sup> century.

\* *More information available:* <http://mree.postech.ac.kr>