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# Polymer Science and Engineering in the Southern Part of the People's Republic of China (South of the Yangtze): Part I: "Shanghai Area"

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Centers of Polymer Research

# Polymer Science and Engineering in Universities in the Southern Part of the People's Republic of China (South of the Yangtze): Part I: Shanghai Area

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Shanghai is the world's most populous city of more than eleven million inhabitants with ten counties within the metropolitan area. It is not only the largest industrial but also the most important cultural center in the People's Republic of China.

There are about sixty universities and colleges in the Shanghai area. For historical reasons, all universities and colleges in China have specialized in specific fields of learning, such as literature, science, the various branches of engineering, medicine and also in the arts (music, drama, etc.). The recent trend of the development of universities and colleges in China is to combine specialized schools or to expand outside

their original specific fields into more comprehensive universities of several related fields of learning. This evolution is particularly true for those universities that are placing emphasis on science and engineering.

One of the fields that has benefitted from this development is polymer science and engineering. Throughout China the education of polymer science and engineering has been quite similar, regardless of location. In universities where the emphasis is on the science aspect of polymer science, the education is placed in Chemistry Departments and is part of the chemistry education. The student of polymer science takes for the first three years the fundamental training of the

## Centers of Polymer Research



East China Institute of Chemical Technology

Kiangnan Universities and shortly thereafter Shandong University. The East China Institute of Chemical Technology now has eleven departments: Chemical Engineering (2), Biochemical Engineering, Applied Chemistry, Materials Science and Engineering, Environmental Engineering, Mechanical Engineering, Automatic Control and Electronic Engineering, and Foreign Languages for Science and Technology. The research facilities are organized in six centers, among them the Chemical Engineering Research Center and the Material Science and Engineering Research Center.

The polymer group of the East China Institute of Chemical Technology was organized in 1958; it is now located in the Department of Material Science and Engineering. The teaching and research faculty in polymer science and engineering consists of forty academically trained persons, including six professors and associate professors: Professor Shijin Li, Shengkang Ying, Deren Zhao and Associate Professors Weisheng Zhang, Xuanmin Zhang and Runpei Zhou. Their research interests are: (1) specialty polymers and composites, (2) anionic polymerization and materials made by anionic polymerization, (3) polymeric materials for medical uses.

Professor Shijin Li, the director of the Institute of Material Science and Engineering is also the head of the department of Material Science and Engineering; he is broadly interested in the synthesis and the study of the relationship of structure and properties of polymers and polymer blends. Li is investigating high performance polymers, such as polyimides, poly(phenylene sulfide) and aromatic polyesters; he is also interested in conductive polymers and polymers for insulation uses. Professor Li's group is also studying the kinetics of radical polymerization and polycondensation.

Professor Shengkang Ying, the deputy head of the department of Material Science and Engineering has in the past worked on radiation effects on polymers and radiation polymerization. Now he is interested in anionic polymerization and copolymerization, the theory of anionic polymerizations, identification of the active species but also on the synthesis of graft and block copolymers by anionic polymerization.

Professor Deren Zhao, the deputy director of the Institute of Material Science and Engineering has, in the past, worked on the polymerization of trioxane and studied the thermal stability of polyoxymethylene. He is now interested in

several fields. In the poly(vinyl chloride) area, he is investigating the morphology and thermal stability of poly(vinyl chloride) and the rheology of poly(vinyl chloride) paste. He has also become interested in Functional Polymers: the synthesis and properties of polymeric antibacterials, and cationic surfactants. His group is also working on the synthesis and application of interpenetrating polymer networks, particularly those based on polyacrylates. The Department of Material Science and Technology is providing a broad basis for teaching and research in polymer science for students interested in polymeric materials and composites. Since 1978 over 30 students have been studying for their masters and doctoral degrees.

### East China Institute of Textile Science and Technology

The East China Institute of Textile Science and Technology has teaching and research facilities in all major fields of textile science and technology, has four departments and several research institutes. All polymer science and engineering activities are in the Department of Textile Chemical Engineering and Man-made Fiber Research Association; in these two organizations 42 professors and lecturers are in charge of over 300 undergraduate and 20 graduate students.

The East China Institute of Textile Science and Technology has as its president, Professor Baojun Qian, who is also director of the Man-made Fiber Research Association. Professor Qian is one of the originators of man-made fiber research in the P.R.C. Beginning in the 1940's, he initially worked on the relationship between the physical structure of fiber and physical properties. He has established the lateral order of cellulose and acrylic fibers and developed a number of testing methods for the characterization of fibers, such as a thermo-mechanical testing instrument, and a dichroism instrument for measuring the orientation in the amorphous phase of fibers. His group is now working on various projects defining



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chemistry major. In the first semester of the senior year, courses in polymer chemistry and polymer physics are offered with some laboratory courses and, in the second semester, it is required that the student works on a thesis project.

In universities which specialize in engineering or technology, the education of polymer science and engineering is in Chemical Engineering or Applied Chemistry Departments. For the first three years (as in Chemistry education) the fundamental training is the same as that of the engineering training in the specific department. In the fourth year polymer related courses are offered with some basic polymer chemistry and polymer physics, but particularly polymer engineering. For the last semester work on a thesis or on a design project is required.

#### Fudan University

Fudan University is one of the most important universities in China and has a history of 77 years. The university originally had only two faculties—science and literature. It is now developing into four schools: literature, social science, natural science and technology. In its present status Fudan University consists of 16 departments: Foreign languages and literature, Chinese Language and Literature, History, Journalism, Philosophy, Economics, International Politics, World Economy, Mathematics, Physics, Chemistry, Biology, Nuclear Science, Management Science, Electronic Engineering; it is also organized into eight research institutes: Mathematics, Genetics, Modern Physics, Material Science, Electric Light Sources, World Economy, Chinese Linguistics and Literature, Historical Geography and two centers: Computer, Analytical and Testing.

Polymer science in this university began as a research group in the Department of Chemistry but later grew into a teaching and research organization. The Institute of Material Science with polymer science as its major part was established and started functioning in 1983. The polymer science part consists of one professor, four associate professors, twenty-five lecturers and two engineers. This group is now responsible for the education of about thirty seniors and 10 graduate students who are working for their M.S. or Ph.D. degrees. The courses offered on the graduate level are: Syn-



Fudan University Chemistry Building

thesis and Reaction of Polymers, Polymer Structure and Properties, Polymer Solution, Viscoelasticity of Polymers and Polymer Characterization.

The research activities in polymer science at Fudan University are concerned with polymer alloys, especially those having polystyrene and polypropylene as their components. The responsibility here is to help the development of commercial polymer alloys such as acrylonitrile butadiene styrene resins and high impact polystyrene. Polymer Research at Fudan University is also trying to improve the manufacturing techniques of these resins. Synthetic methods for these polymerizations include sequences of bulk and suspension copolymerizations. The investigation of the polymerization of propylene involves primarily the study of the polymerization in bulk; the research group has developed high efficiency multiple-component initiator systems which work excellently in small scale production. Research is also being done on high temperature and moisture-resistant heterocyclic polymers, pressure sensitive and other specialty polymers.

Theoretical studies are carried out to support some of the more practical problems, mostly in the field of morphology, structure/property relationship and compatibility of polymers. Research in this group is also in progress on ESR studies of molecular motion in polymers by means of spin probe and small angle laser light scattering studies of biomacromolecules.

Professor Tongyin Yu, now the director of the Institute of Material Research, worked originally on organo-silicon compounds. His research in polymer science includes the study of the mechanism of primary radical termination and the kinetics of polycondensation to form polysulfones. He is also interested in the dynamic properties of polymers, ESR studies to determine polymer transitions by means of the spin probe technique and investigation of the morphology of polymer blends. His group has succeeded in developing a new type of high impact polypropylene and a new material for making aerators used in surgery.

Associate Professor Lingyun Xu is working on the anionic polymerization of styrene and butadiene to synthesize star-type block copolymers. Her group has also developed novel specialty adhesives from these copolymers.

Associate Professor Manjun is interested in inverse gas chromatography for investigating solubility parameters of polymers. She is now also interested in light scattering. Her group is modifying the apparatus to adapt it for the study of biomacromolecules.

Associate Professor Lihui Wang's interest is in the ultra-extrusion of polymers and the physical characterization of these products. His group works also on the liquid phase bulk polymerization of propylene and on blends of polypropylene.

Associate Professor Jingyong Ye is involved in grafting of methyl methacrylates and styrene onto polybutadiene in order to develop ABS-like copolymers which are tough and transparent. His group has made new copolymers of this type which are now in commercial production in the P.R.C.

#### East China Institute of Chemical Technology

The East China Institute of Chemical Technology is one of the big universities specializing in chemical technology. It was founded in 1952 by combining the Chemical Engineering departments of Chiao Tung, Aurora, Tatung, Soochow and

better the structure-property relationship, lateral order, supermolecular structure, texture and crimping of cellulose, viscose and acrylic fibers.

Professor Tong Sun, who is the codirector of the Man-made Fiber Research Association, is working on polymer rheology, polymer transitions, characterization of block copolymer structure of polyurethane fibers, graft copolymerization of various monomers onto cellulose, the influence of speed in high-speed spinning on the fiber structure. He is also studying the structure-property relationship of poly(ethylene terephthalate) film obtained by solid state coextrusion.

Associate Professor Fanting Li also a codirector of the Man-made Fiber Research Association is working on the mechanism of fiber fracture and the conformation of flexible polymer chains.

In addition to these two organizations within the East China Institute of Textile Science and Technology, several other professors involved in polymer science and engineering are located in other departments of the Institute but are mainly working on natural fibers: Professor Haojing Yan, Vice-president of the Institute, and Associate Professors Kai Sun, Hong Zhou and Zhilian Tang.

#### Shanghai University of Science and Technology

The Division of Polymer Science of this University belongs

to the Department of Chemistry and Material Science, founded in 1980; it now has one associate professor and seven lecturers. In addition to their responsibility in educational programs, their research subjects emphasize synthetic polymer chemistry and radiation chemistry of polymers. Associate Professor Zuete Ma is an expert in radiation chemistry and works on the radiation chemistry of polymers. The rest of the staff members are interested in biologically active polymeric materials, acrylic coating, magnetic coating and acrylic adhesives.

#### Tongji University

Established in 1907, Tongji University originally consisted of five colleges: science, engineering, medicine, literature and law. In recent years, Tongji University became a center of excellence in civil engineering, but now it is expanding into science, medicine and engineering. Tongji University consists of 16 departments: the Department of Chemistry and the Department of Construction Materials have components of polymer science and engineering. Professor Yunyuan Wang is working on polymer/concrete mixtures and Associate Professor Jingwang Yuan on polymer additives. Other scientists involved in polymer research in these two departments are studying non-equilibrium kinetics of ionic polymerization and polymer rheology.