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# Centers of Polymer Research; Polymer Science and Engineering in Academy Institutes in the Southern Part of the People's Republic of China (South of the Yangtze)

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Centers of Polymer Research

## Polymer Science and Engineering in Academy Institutes in the Southern Part of the People's Republic of China (South of the Yangtze)

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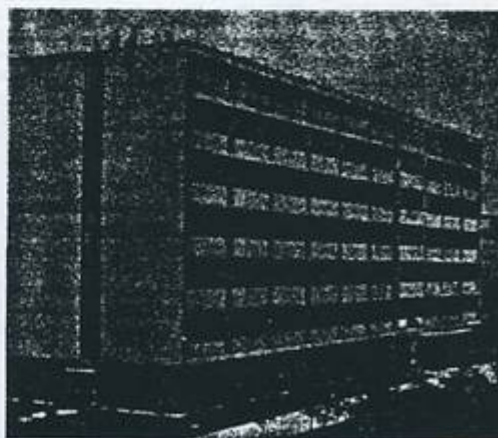


Otto Vogl

### Shanghai Institute of Organic Chemistry, Academia Sinica

Shanghai, with a population of about 11 million, is the biggest city in the P.R.C., and is located within the estuary of the Yangtze River, directly on the Hangpo River; the Yangtze flows into the China Sea near the central part of the coastline of mainland China. Shanghai is one of the most, if not the most, important industrial centers of China for both heavy and light industries.

Shanghai Institute of Organic Chemistry was founded in 1950; it is located in the southwestern district of the city and has now about 400 academically trained scientists including 45 research professors and associate professors. The research activities of the Institute fall into three main categories: (1) Chemistry of organic natural products and bioorganic chemistry, (2) Elemental organic chemistry, (3) Physical organic chemistry. In addition, there are two major special projects under separate investigation: Organic extractants and chemistry of liquid crystals. Research in polymer science is carried out in the Laboratories of Organic Fluorine Chemistry and Fluoropolymers, and the Laboratories of Bioorganic Chemistry.



Shanghai Institute of Organic Chemistry  
New Research Building



### Laboratories of Organic Fluorine Chemistry and Fluoropolymers

These laboratories were established in 1960 with the initial work directed toward the synthesis of fluorinated lubricants and fluoropolymers. It now has two professors and six associate professors; polymer research is being carried out in several groups.

Professor Weiyan Huang, the deputy director of the Institute and head of the Laboratory, has organized the laboratory into research groups responsible for synthetic fluorine chemistry, fluoropolymers, and polymer physics. He is conducting research with Associate Professor Xingyi Dai in the field of polymerization and copolymerization of fluorolefins including difunctional monomers and perfluoroepoxides. The effect of type of initiators and solvents on the polymerization; the structure and configurations of copolymers, the structure-property relationships, and melt processing of these polymers, are being investigated. Fluorinated ion exchange membranes for industrial applications are also being developed. In collaboration with Associate Professor Changming Hu, a new synthetic route to thermally stable fluorinated triazine monomers and polymers has been developed.

Professor Yulin Tian is devoting his research activities to the polymerization of methyl methacrylate and the synthesis of tetrafluoroethylene and the preparation of its homo- and copolymers. Associate Professor Zhikang Lu is mainly working on the copolymerization of tetrafluoroethylene with ethylene; some modifications in polymerization process are being carried out in order to improve the thermoplastic properties of the product. Associate Professor Qingyun Chen is interested in the synthesis of fluorine containing polyacrylates as water/oil repellent for textile finishing.

Associate Professor Guanyi Shi and his group are working on the understanding of the relationship between structure and properties of polymers, with special emphasis on fluoropolymers, such as polytetrafluoroethylene and copolymers of tetrafluoroethylene. They have detected a melt transition of the 6:1 tetrafluoroethylene-hexafluoropropylene copolymer and the tetrafluoroethylene-perfluoroalkylvinyl ether copolymer (PFA), based on the measurements of the melt properties by differential scanning calorimetry, torsional braid analysis, small angle light scattering, and melt viscosity. They are also studying the morphology and the physical properties of polypropylene with relatively high amounts of the  $\beta$ -modification.

Associate Professor Baozhu Wu and her group are carrying out investigations of piezoelectricity and pyroelectricity of some fluoropolymers, especially poly(vinylidene fluoride) and tetrafluoroethylene-vinylidene fluoride copolymer. They are also working on electrets in polymers and exploring the uses of such polymers in medicine. One of the electrets has been found to be a candidate for practical applications as electro-acoustic transducer.

Research Associate Xiangzhen Zhao is interested in the application of fast electron preirradiation techniques for polymer modifications, such as radiation graft polymerization of vinyl monomers onto the surface of fluoropolymers. A number of graft fluoropolymers with special functional groups have been prepared and their structure-property relationship are now under study.

### Laboratories of Bioorganic Chemistry

Under Professor Yu Wang, the director of the Shanghai Institute of Organic Chemistry and the head of the Laboratory of Bioorganic Chemistry, peptide chemistry is being investigated. This work is being done in cooperation with Associate Professor Jiecheng Xu. Among the many and varied activities are the following contributions:

The successful total synthesis of crystalline bovine insulin (in cooperation with the Institute of Biochemistry, Academia Sinica, and the Chemistry Department of Peking University).

Syntheses of bioactive oligopeptides such as peptide fragments of the coat protein of the tobacco mosaic virus, leucine enkephalin, delta sleep inducing peptide, have been carried out by methods of organic chemistry and by enzymatic methods.

The group of protein chemistry under the leadership of Associate Professor Liqing Zhang and Research Associate Shanwei Jin has elucidated the amino acid sequence of the crystalline protein trichosanthin, which was isolated from the root tuber of *Trichosanthes kirilowii* Maxim, Cucurbitaceae and which is effective in inducing abortion and curing hydatidiform mole.

The group of nucleic acid chemistry, under the leadership of Associate Professor Jingjian Huang and Associate Professor Chuanzhong Tu have been involved in the total synthesis of yeast alanine t-RNA (in cooperation with other Institutes of Academia Sinica, Biology Department of Peking University, and Shanghai Reagent Factory No. 2). They have also applied NMR spectroscopy to the study of reaction mechanisms and kinetics of nucleotides.

The group of polysaccharide chemistry under Associate Professor Chuanzhong Tu is studying carbohydrate chemistry including biologically active and industrially useful polysaccharides, such as carboxymethyl amylose and carboxymethyl starch as new plasma extenders.

### Guangzhou Institute of Chemistry, Academia Sinica

Guangzhou Institute of Chemistry is located in the eastern district of the City of Guangzhou, the most important industrial and cultural center in southern China. The Institute was founded in 1958 and reorganized in 1961; today it consists of 9 departments. Polymer research is primarily carried out in three fields: Adhesives and Caulking Materials, Cellulose Chemistry and Technology, and Polymer Physics.

### Laboratory of Adhesives and Caulking Materials

Associate Professor Zuozhou Ye, the deputy director of the Institute, has for many years been interested in the study of *in situ* polymerization of acrylic acid monomers and of their industrial applications as macromolecular caulking materials. His early works included the *in situ* polymerization of methyl methacrylate, acrylamide, and epoxy oligomers. The first successful use in China of an epoxy oligomer and acrylamide as a caulking material by *in situ* polymerization was achieved in his laboratory. Several kinds of caulking materials which are currently in use such as modified lignin-Cr(VI) complex and modified polyurethanes were first developed in this Institute.



A group headed by Research Associate Jinsuo Li is working on partially hydrolyzed polyacrylamide which is used for enhanced oil recovery. This research team is also exploring new monomers for *in situ* polymerization.

Research Associate Zhonhe Lu and his group are devoting their research activities to the study of adhesion and adhesives. They are especially concerned with adhesives of high bond strength and/or curable in water at ambient temperature. Research Associate Yingtai Yang is working on anaerobic adhesives and water soluble polymers.

#### Laboratory of Cellulose Chemistry and Technology

Associate Professor Zhenya Zhang, the other deputy director of the Institute, and his research group have been investigating the modification of cellulose under plasma irradiation and the graft polymerization of cellulose with acrylic monomers such as acrylamide. Another group is working on techniques to decrease the crystallinity of cellulose and cross-linking of cellulose in order to improve the properties of ramie and jute fiber.

The laboratory directed by Associate Professors Jie Gao, Qinghui Qi, and Fengmie Change is also involved broadly in cellulose chemistry and technology. They developed a new high wet-modulus fiber made from bagasse and are now working on the chemical characterization of bagasse. Synthesis of new cellulose derivatives with unique properties and the application of some cellulose membranes containing functional groups is also under investigation.

Associate Professor Feng Liang is interested in the chemistry of modified natural fiber and in fiber spinning technology. His research activities also include reactions of cellulose in the homogeneous phase, the preparation of cellulose derivatives and their application, immobilized enzymes based on derivation of cellulose and nonaqueous solvent systems for cellulosic materials. Recently his group has been also working on the preparation of high performance crimped viscous fiber.

#### Laboratory for Polymer Physics

Associate Professor Pantong Li is conducting research

in polymer physics. In cooperation with Associate Professor Feng Liang, the structures of modified polypropylene resin, polypropylene fiber, as well as polymer blends of polypropylene with polyethylene, polystyrene, polyesters and polyamides are being investigated.

#### Chengdu Institute of Organic Chemistry, Academia Sinica

Chendu, the provincial capital of Sichuan and a city of 3.7 million inhabitants, lies on the Chengdu plain in the northwestern part of the Sichuan Basin. It is the largest city and the most important inland port in southwestern China. Chengdu Institute of Organic Chemistry was founded in 1958; it is located in the southern part of the city.

The laboratory of polymer science is led by Associate Professor Mengjun Cao. His group is working on the synthesis of functional polymers such as polymer catalysts, polymer-immobilized crown ethers, and polymers for medical use. It has been demonstrated that the polymeric catalysts from copper complexes of epichlorohydrin and imidazolymethylethylene oxide copolymers can be used to promote very efficiently the oxidative coupling of 2,6-dimethylphenol to poly (2, 6-dimethyl-1, 4-phenylene oxide). Their present research includes the synthesis of optically active helicoidal polymer-metal complexes; they are now examining the dependence of the activity and stereoselectivity of such complexes as initiator systems for cyclic ether polymerizations, and are studying the initiator efficiency as a function of the regularity and flexibility of the polymer chain. The research group is also interested in the synthesis of poly (amino acids) by matrix polycondensation and the application of such materials as bone cement.

Associate Professor Guizheng Ziao is investigating the ring-opening polymerization of cyclic ethers and lactones with special emphasis on new initiating systems. Research Associate Xuemin Gao is working on the synthesis of polyurethane elastomers, some of which show exceptionally good abrasion resistance. Research Associate Yuanhang Li is developing new polymer blends and composites and Research Associates Zhengjie Gong and Tianbao Huang are working on characterization of synthetic polymers by various instrumental methods.



Mengjun Cao in front of Chengdu Institute of Organic Chemistry, Chengdu, Sichuan, P.R.C.