1983

# Centers of Polymer Research; Polymer Science in Northeastern Japan

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**T. Yamaguchi and O. Vogl, *Centers of Polymer Research; Polymer Science in Northeastern Japan,* Polymer News, 9(3), 89-91 (1983)**

Centers of Polymer Research

# Polymer Science in Northeastern Japan

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Northeastern Honshu is known as the Tohoku (northeastern) or Ohu district and consists of six Prefectures, Aomori, Iwate, Akita, Miyagi, Yamagata and Fukushima, with the city of Sendai serving as the district's center. The Tohoku district is mountainous with the Ohu mountain range running through the central portion of the district. Sendai, with over one-half million inhabitants, is the capital of Miyagi prefecture and the cultural, political and economic center of the Tohoku district.

TOHOKU UNIVERSITY: Sendai, Miyagi Prefecture.

The University was founded in 1907 and has eight faculties: Law, Literature, Education, Economics, Medicine, Science, Technology and Agriculture. A number of Research Institutes are associated with or part of the University.

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*Polymer News*, 1983, Vol. 9, pp. 89-91
0032-3918/83/0903-0089$18.50/0

Faculty of Engineering

*Department of Applied Chemistry:* Professor Kaoru Umeya's specialty is ceramic engineering, especially ceramic fabrication processes using dry, wet and suspended powder as raw materials. With Instructor Ryuichi Hara, he is working on viscoelasticity of polymer powder compaction and fluidity of suspensions in aqueous polymer solutions. With Instructor Yasufumi Otsubo, he is studying the viscoelasticity of polymer suspension in glycerol and the fluidity of cement and gypsum paste.

Professor Tadashi Yamaguchi has broad interests in polymer chemistry and technology. His present research consists of: synthesis of composite materials by in situ polymerization of vinyl monomers in the presence of inorganic compounds, synthesis of non-linear block copolymers using polyfunctional anionic initiators, and development of new polymerization processes using rotating-disk atomizers or impinging jet atomizers.

Faculty of Engineering, Yamagata University


1. Sendai
2. Yonezawa
3. Morioka
4. Koriyama
5. Yamagata
6. Akita
7. Aomori

Instructor Masayuki Nozawa is working on anionic polymerization of divinyl monomers such as poly(ethylene glycol) dimethyacrylates. He is investigating the relationship between the conformation and the mode of the polymer as the polymer propagates.

*Department of Chemical Engineering:* Professor Shozaburo Saito is interested in polymerization reaction engineering. He is studying the rates of bulk and heterogeneous radical polymerizations over the entire range of reaction conditions for the purpose of designing and optimizing of polymer reactors.

*Chemical Research Institute of Non-aqueous Solutions:* Professor Masahiro Hatano is interested in the electronic states of simple organic molecules, metal complexes, and biopolymers. Circular dichroism (CD) and magnetic circular dichroism (MCD) data have been compared with those obtained theoretically from molecular orbital calculations. Recent developments include theoretical elucidation of the CD and MCD spectra of a number of molecules. Further application of CD and MCD for the structural analyses of the more complicated molecules such as dinucleotide-aromatic compound complexes or multi-nuclear metal complexes is now in progress.

Associate Professor Tsunenori Nozawa is involved in the diagnostic application of MCD for various hemoproteins including cytochrome P-450 or tryptophan-2,3-dioxygenase. He uses an Ab initio calculation for the elucidation of the observed MCD data. Recently he added NMR techniques to his studies, especially $^{57}Fe$, $^{17}O$, $^{33}S$ NMR spectroscopy, in attempts to classify the structures of hemoproteins in biologically active tissues. Magic angle spinning technique for the $^{13}C$ NMR signals of biological samples in the solid state is also being used.

Professor Kenkichi Murakami is working on the relation between structure and properties of polymers, with special emphasis on natural polymers such as polysaccharides or proteins. He is using chemorheology as a new technique to obtain new insight into the structures of these polymers.

Associate Professor Tamio Yasukawa is interested in the use of computers in polymer chemistry for the evaluation of kinetics of polymerization, polymer synthesis including grafting reaction, but also for prediction of polymer properties.

Professor Minoru Matsuda is working on the reactivity of transient species formed from organic sulfur-containing compounds. The reactivity of thiyl and sulfonyl radicals in addition reaction involving vinyl monomers and of thiolate anions and carbanions having neighboring sulfur groups in electron transfer reaction is being studied by xenon and laser flash photolysis. Associate Professor Masahi Iino is also interested in the reactivity in sulfinyl radicals.

YAMAGATA UNIVERSITY: Yonezawa, Yamagata Prefecture.

Faculty of Engineering

*Department of Polymer Chemistry:* Professor Naomichi Takahashi is measuring the fine structure of solid high polymers and their interactions with water. With Associate Professor Fumio Suzuki he is studying the separation of liquid mixtures by evaporation techniques with flat membranes prepared from natural and synthetic polymers.

Professor Yoshio Imai is broadly interested in synthetic polymer chemistry, especially the synthesis of condensation polymers. He is currently studying the synthesis of novel thermally stable heterocyclic polymers, polycondensation by phase-transfer catalysis, Michael-type polyaddition, and ring-opening polymerization of heterocycles. Associate Professor Mitsuru Ueda is involved in fundamental studies on polyamide synthesis with activated carboxylic acid derivatives; he also works on ring opening polyaddition, vinylogous nucleophilic substitution polymerization, as well as the synthesis of electron beam sensitive vinyl polymers.

Professor Shigeru Hayama is working on the synthesis of polymers containing biphenyl units in the chain, vinyl copolymers and oligomers, and the scission of biphenyl-4,4'-bisazothioarylethers and other esters at room tem-

perature in aqueous systems and polar solvents. Associate Professor Makoto Takeishi is involved with the synthesis of functional polymers and vinyl copolymers; he is also studying the solvolyses of activated esters and azolides (heterocyclic amides) catalyzed by polymeric nucleophiles as models for hydrolytic enzymes. He is also interested in electron transfer reactions involving redox polymers.

Professor Toshikazu Fujimura is investigating the rheological behavior of thermoplastic polymers and the recycling of chemical reagents. Associate Professor Kenji Iwakura is studying melt rheology and its application to the processing of polymer composites. Polymer blends, filled polymers, chain extended polyethylene and two-phase composites are particularly investigated.

Professor Mikio Karasawa is interested in the chemistry and technology of dying, the diffusion behavior of dye molecules through fibers and films, and the sorption mechanism of dyes. He is currently studying the behaviors of disperse dyes and the acid dyes on polyesters and polyamides (nylon 6) films with special emphasis on the precise measurements of the diffusion coefficients. Associate Professor Toru Masuko is studying the relationships between disperse dye sorption mechanism and fine structure of hydrophobic polymers as a function of the segmental mobility of polymer molecules.

Faculty of Engineering

*Department of Textile and Polymer Technology:* Professor Osamu Ishizuka is investigating the melt spinning of synthetic polymers and glass. He is evaluating, by x-ray and birefringence measurements, the development of structure during melt spinning as it relates to the materials history before melt spinning; he is also interested in the elongational viscosity of the melts which is measured by isothermal melt spinning in an elongational rheometer with constant strain rate. Instructor Masao Okamoto is working on the characterization and degradation of polymers, expecially the termal degradation of polyacrylonitrile and poly(α-chloroacrylonitrile).

Associate Professor Kazuo Matsuda is working on the strain behavior of crystalline polymers and on electrical properties of solid polymers at different temperatures.

Professor Masakazu Matsumoto is interested in poly(vinyl alcohol) and other water soluble polymers such as poly(vinyl pyrrolidone) and poly(ethylene glycol). He is studying the behavior of these polymers on aqueous reactions including crosslinking.

Associate Professor Yoshiaki Fujikura is working on the thermal, thermophysical and radiation properties of polymer films especially the emissivities of polymer films at room temperature.

Professor Hiroyuki Ogawa is making composite fibers of silk and synthetic fibers. He is also studying the mechanical properties of amorphous polymers, especially the yield behavior of glassy polymers with respect to crazing and shear deformation. He is analyzing the sites of fracture initiation of those polymers by a slip line field theory. Associate Professor Ikuo Narisawa is working on fracture and crazing of glassy polymers based on fracture mechanics, thermodynamics, statistical and morphological analyses, and the fatigue behavior of polymers. With Professor Ogawa, he is investigating the impact behavior of propylene-ethylene block copolymers and their composites with respect to shear and microcrazing.

*Polymer Material Laboratory:* Professor Takao Ishinabe is investigating phase transition behavior in crystals, critical phenomena and adsorption mechanism in polymer systems. Associate Professor Toru Taga is interested in characterization of graft copolymers prepared from cellulose and vinyl monomers. He is currently evaluating the actual percentage of the grafting sites by combined thin layer chromatography and functionality of endgroups of cellulose molecules. Associate Professor Hiroshi Tanaka is investigating the magnetic relaxation behavior of polymer solids and the thermal properties of polymer films which have a fine structure, generated under ultra high stretching techniques followed by long time annealing at high temperature. Associate Professor Katsutoshi Nagai is studying the synthesis of monomers with surfactant properties and their polymerization reactions. He is measuring coagulation properties in several solutions containing other functional reagents, and in relating the interactions between functional groups of monomeric species with those of polymers.

IWATE UNIVERSITY: Morioka, Iwate Prefecture

Faculty of Engineering

*Department of Applied Chemistry:* Professor Yoshiro Nakamura and Associate Professor Kunio Mori are interested in the utilization of triazinethiol compounds as rubber processing chemicals, as polyfunctional crosslinking agents, as reactive stabilizers, as novel crosslinking agents for rubber blends, as coupling effects for polymer-metal bonding, and as metal deactivators.

NIHON UNIVERSITY: Koriyama, Fukushima Prefecture.

Faculty of Engineering

Professor Masamichi Katayama is working in cyclocopolymerization of diene derivatives and sulfur dioxide and he has been studying the synthesis and properties of the copolymers of olefin and sulfur dioxide. Associate Professor Yoshihiko Musha is investigating the quantitative analysis of copolymers by pyrolysis-gas chromatography and by infrared spectroscopy. Instructor Yoshikazu Sato is interested in the polymerization behavior and thermal properties of polyaminoquinones. With Professor Katayama, he is also studying their properties and synthesis of the cyclic copolymers containing sulfur dioxide in the main chain.