Chemical Structure and Physical Properties of Cyclic Olefin Copolymers (IUPAC Technical Report)

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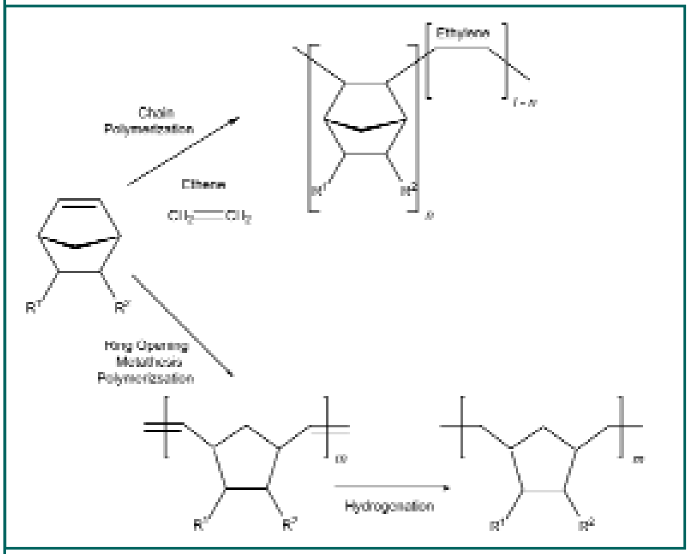
The modification of general-purpose polyolefin materials in order to enable their use as engineering plastics is currently a relevant topic for industrial as well as academic research. Cyclic olefin copolymers comprise one of the new classes of polymers based on cyclic olefin monomers and ethene. Because of the bulky cyclic olefin units randomly or alternately attached to the polymer backbone, the copolymer becomes amorphous and shows the properties of high glass-transition temperature, T_g, optical clarity, low shrinkage, low moisture absorption, and low birefringence.

With these properties, the application of cyclic olefin copolymer has now been extended to production of plastic lenses and optical storage media, and is currently being produced by Mitsui Chemical Co., Ticona (formerly Hoechst Celanese), Japan Synthetic Rubber, and Zeon Chemicals Co.

There are several types of commercial cyclic olefin copolymers based on different types of cyclic monomers and polymerization methods. Cyclic olefin copolymers are produced by chain copolymerization of cyclic monomers such as 8,9,10-trinorborn-2-ene (norbornene) or 1,2,3,4,4a,5,8,8a-octahydro-1,4:5,8-dimethanonaphthalene (tetracyclododecene) with ethene, Ticona's TOPAS, Mitsui Chemical's APEL, or by ring-opening metathesis polymerization of various cyclic monomers followed by hydrogenation (Japan Synthetic Rubber's ARTON, Zeon Chemical's Zeonex and Zeonor).



Typical polymerization scheme for a cyclic olefin polymer.

Recently, a considerable amount of work has been reported on the physical properties and microstructure of cyclic olefin copolymers. Most of these reports correlated the composition, microstructure, and thermal properties of ethene-norbornene copolymer. A few studies have been made on the influence of chemical structure on the thermal properties of cyclic olefin copolymers. There is no report on the surface characteristics of these polymers.

This paper analyzes the chemical structure of the currently commercialized cyclic olefin copolymers by ^{13}C NMR, and investigates their glass-transition temperatures and surface characteristics. It was observed that the glass-transition temperature of cyclic olefin copolymers depended on the bulkiness of the main chain, and the number of rings had an important role in increasing the bulkiness of cyclic olefin copolymers. Cyclic olefin copolymers with polar substituents such as ester or ether groups showed high surface energy per area and peel strength.

www.iupac.org/publications/pac/2005/7705/7705x0801.html

Polyaniline: Thin Films and Colloidal Dispersions (IUPAC Technical Report)

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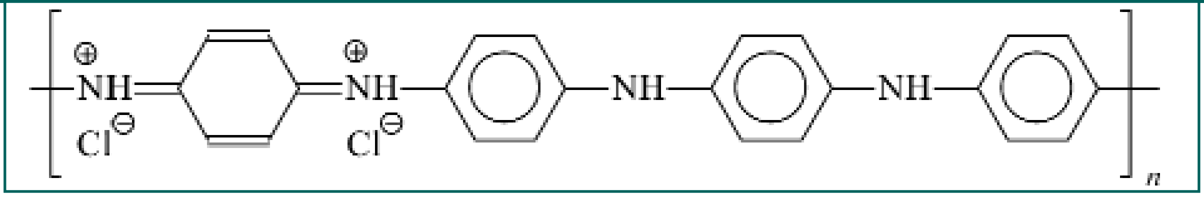
Polyaniline (PANI) is one of the most important and widely studied conducting polymers. It is easily prepared (e.g., by the oxidation of aniline with ammonium peroxydisulfate in acidic aqueous medium) and obtained as a precipitate. Such synthesis has recently been investigated within IUPAC project 1999-024-1-400, "Polyaniline: Preparation of a Conducting Polymer," and a report has been published in *PAC* **74**, 857–867 (2002).



Polyaniline (emeraldine) hydrochloride (one of the possible presentations).

Polyaniline protonated with inorganic acids is difficult to process because it cannot be dissolved or melted below the decomposition temperature in the conducting state. The protonation of PANI with organic acids having a bulky hydrocarbon component has been used to increase the solubility of PANI in organic solvents and the plasticity. The uses of dodecylbenzenesulfonic acid, dinonylnaphthalenesulfonic acid, or diesters of sulfosuccinic acid may serve as examples. Various surfactants have also been used as a component of the reaction mixture for the same purpose. Alternative processing strategies consist in coating of the surfaces of various substrates with a conducting PANI film and in the preparation of PANI colloids. The latter forms, produced in situ during the polymerization of aniline, are discussed in this paper.

An authority on conducting polymers has pointed out that "there are as many different types of PANI as there are people who synthesize it." The purpose of this collaborative study was to test this statement, by having various researchers follow the same preparative protocol. Two supramolecular PANI forms, thin PANI films on glass and colloidal PANI dispersions stabilized with poly(N-vinylpyrrolidone) (PVP), were prepared independently in several laboratories. In this study, the films and colloids were characterized with respect to film thickness, film conductivity, and colloidal particle size.

The average thickness of the films, assessed by optical absorption, was 125 ± 9 nm, and the conductivity of films was 2.6 ± 0.7 S cm^{-1}. Films prepared in 1 mol l^{-1} HCl had a similar thickness, 109 ± 10 nm, but a higher conductivity, 18.8 ± 7.1 S cm^{-1}. Colloidal polyaniline particles stabilized with a water-soluble polymer, poly(*N*-vinylpyrrolidone) [poly(1-vinylpyrrolidin-2-one)], have been prepared by dispersion polymerization. The average particle size, 241 ± 50 nm, and polydispersity, 0.26 ± 0.12, have been determined by dynamic light scattering. The preparation of these two supramolecular polyaniline forms was found to be easily reproducible.

www.iupac.org/publications/pac/2005/7705/7705x0815.html

Terminology in Soil Sampling (IUPAC Recommendations 2005)

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Recently, there have been a growing number of efforts to overcome confusion, ambiguity, and contradictions in the usage of terms and clarification of their definitions in the field of sampling. The IUPAC Recommendations, "Nomenclature for Sampling in Analytical Chemistry," published in 1990 (*PAC* **62**, 1193–1208), and the ISO standard 11074-2, "Soil Quality—Vocabulary—Part 2, 1998," are the most widely used terminology documents related to soil sampling. However, recent developments and studies of various sampling aspects (i.e., uncertainty quantification, method validation, comparison of sampling tools, and strategies) require new concepts to be developed and also some new terms to be introduced for their description.

One of the outcomes of the SOILSAMP international project, funded and coordinated by the Italian Environmental Protection Agency (APAT, Italy) and aimed at assessing the uncertainty associated with soil sampling in agricultural, semi-natural, urban, and contaminated environments, was an updated terminology in sampling.

This paper is the result of that effort, and is intended to present terms and definitions to be used in soil sampling and sampling uncertainty. A set of geostatistical terms, of interest in the context of soil sampling and sampling uncertainty estimation, is also illustrated together with the recommended definitions.

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