

Research Proposed

1. Study of the basic chemistry of their polymerization, which includes the effect of the counter-ion, polymerization method, etc.
- 2a. Study of the polymer structure, perhaps by generating soluble polymers which can be characterized much more easily than the cross-linked ones. Here too, the counter-ion could be an important factor in structure formation.
- 2b. Newer techniques of characterization: Solid state NMR, EXAFS, small angle X-ray, neutron scattering, etc. can be applied to the study of the polymer structures.
3. New polymerizable monomers which could allow one to vary E_0 , σ , etc.
4. Nature of transport in these systems - electrical and ionic.
5. Polymer electrodes have been made. Work on polymer semiconductor interactions and polymer-polymer junctions has been started and should continue.

1.2 Preformed Heterocyclic Polymers, Dopable for Conductivity

Scope

Polymers of this type have been made for twenty-five years as part of the drive for thermally stable polymers. Undoped, many of this class are extremely oxidatively and thermally stable. It includes poly-quinoxalines, oxadiazoles, triazoles, thiadiazoles, benzoxazoles, benzothiazoles, benzimidazoles, phthalocyanines, porphorins, etc. While most are insulating as made, some have been doped and can show high conductivity in the doped state. Only one of the polymers is made in large quantity, a poly(benzimidazole), while a few are produced experimentally. Work to date has been on off-the-shelf polymers synthesized for other programs, with uncertain history.

Justification

These polymers can be made easily and are very stable. Many are soluble and can be preformed into fibers or films before doping. Others can be made in fiber or film form from soluble pre-polymers.

They can be easily handled and formed and doped when in the final configuration. While the doped polymers tend to be air and water sensitive, they can be highly conductive and can serve as polymer electrodes. The wide variety of structures can generate a wide variety of properties.