Status

Work on these materials has been reported only in the last few years. Very few of the systems have been studied and none in depth.

Research Proposed

1. A survey of the various polymers with various doping agents should be carried out.

2. In the interesting cases, structure-property relationships should be determined.

3. Does structure alter with doping?

4. For interesting polymers, the syntheses should be optimized, and analogues made to claify structure-property relationships.

1.3 Aromatic Ladder Polymers: Potential Intrinsic Semiconductors or Conductors

Scope

This class of materials is mainly ladder polymers, both of the fully aromatic type - the heterocyclic equivalent of polyacenes where an aromatic carbon is replaced by aromatic nitrogen - and those which have aromatic groups replaced by sulfur and/or oxygen. Such polymers have been made recently by direct synthesis. They have one or two parallel sets of alternating double and single bonds, either as they are made, or after oxidation for those polymers with O and S in the backbone.

Justification

Such polymers may be intrinsically conducting. Calculations or polyacenes show that there is no localization of π electrons in this system. We hope that this will also be true of the heteroaromatic systems. In the worst case, they should be intrinsic semiconductors and become conductors when doped. Recent work on one such system shows that this is true. Many of these polymers are extremely thermally and oxidatively stable. Some are soluble in exotic solvents and may be processable. In many cases, the polymers have a regular structure and may be crystallizable. Most can be liquid crystal when processed properly.

Status

Very few from a potentially wide range of polymers have been made, and even fewer studied in any depth. Characterization of even the basic structures is almost non-existent. Doping and electrical characterization is just starting for some of the polymers. Undoped systems have been made which are semiconductors with $\sigma_{25} = 10^{-5}$ S/cm. In doped systems, a conductivity of 1 S/cm has been reached.