

## 1.0 Introduction

Most of the people in this section were involved with synthesis and the topics reflect this bias. As the overall study concerns conducting and semiconducting polymers, characterization techniques are well developed and research topics for that area are considered in other sections. The broad area of heterocyclic polymers was broken down into three sections based on the synthetic approach and treatment of the polymer to make it interesting electrically. The three subdivisions were:

1. Electropolymerized heterocycles which are conducting as formed.
2. Preformed polymers with heterocyclic units which are insulating unless doped. [The equivalent non-heterocycle would be poly(p-phenylene).]
3. Heterocyclic polymers with extended conjugation when made, i.e. intrinsic semiconductors or conductors.

### 1.1 Electropolymerized Heterocycles

#### Scope

There are many materials made this way. The two best known are poly(pyrrole) and poly(thiophene). The effect of substituents has also been studied. Also, polycyclic analogues have been reported recently. Most electropolymerized polymers are made from five membered ring heterocycles, and are generally produced in a cross-linked form of uncertain structure. While most of such polymers are poor conductors, some of the polypyrroles and polythiophenes are excellent conductors.

#### Justification

Such polymers are easily made by electropolymerization and are conductive as such. They tend to be stable towards oxygen when oxidized and some can be completely unaffected by water. This is a tremendous advantage over many of the other types of conducting polymers.

#### Status

Some of these materials are being commercialized to produce conducting films, antistatic materials, and organic electrodes. The various starting heterocycles allow oxidation potentials to be varied systematically over a broad range for many different uses. However, while applications are developing and the range of polymerizable compounds is enlarging, their basic structures and the detailed nature of the polymerizations are still unclear.