Final Report

The electrochemistry of organic polymers involving oxidation or reduction of the polymer backbone and its application to electrical storage is still a very new field of endeavor, the first preliminay paper on this subject appearing in 1979. The discovery that the backbone of an organic polymer having an appropriate type of bonding can be reversibly oxidized and reduced electrochemically with, in certain cases, little irreversible degradation, opens up a new potential field for electrical energy storage. It shows that certain types of organic polymers can act as a storage medium for electricity and that the stored charge can be delivered on demand at a rate which could be useful in practical cells. In view of the newness of the field, and the potentially enormous number of synthesizable new polymers, it seems improbable that the best polymers have necessarily yet been found. Real long-term advances can only be accomplished by detailed chemical and electrochemical studies of different types of polymers and of the principal and side reactions which occur during their storage and recycling under a wide variety of experimental conditions.

Research supported in whole or in part by this contract has resulted in the publication of 26 papers in scientific journals in addition to one which has been submitted for publication. The work has developed into two related chief thrust areas as it progressed:

(1) A study of the chief characteristic chemical and physical properties of polyacetylene, $(CH)_x$ necessary to obtain a solid scientific foundation to permit the performance of studies in the second thrust area. Exploratory studies on other potentially important conducting polymers has also been performed (Reprints: 1, 3, 4, 5, 10, 14, 16, 23).

(2) Detailed electrochemical studies of $(CH)_x$, p-doped polyacetylene i.e. $[(CH^{+y})A^-_y]_x$ (where A^- is an anion), and n-doped polyacetylene i.e. $[M^+_y(CH^{-y})]_x$