Conductive Materials Based On Delocalized Carbanions

by

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Prepared for Publication

in the

ACS Division of Polymer Chemistry, Polymer Preprints

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August 1, 1987

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Studies on the preparation of organic conductors based on delocalized carbanions are presented. The synthesis of sodium and potassium diphenylmethyl anions and potassium \( \text{Ar}-\text{Ar}'\text{-diphenylxylenyl dianion.} \) The anions were characterized by gas chromatographic analysis of protonated quench products. Preliminary DC conductivity measurements indicate a conductivity of \( 5 \times 10^{-18} \text{cm} \) for sodium diphenylmethyl anion. The synthesis of polyethers containing the diphenylmethyl structural unit are described.
INTRODUCTION

Organic materials which possess metal-like conductivity have long been of interest to chemists. Since 1977, when it was demonstrated that polyacetylene on treatment with a variety of electron donors or acceptors could be transformed from a semiconductor to a metal-like conductor, interest in polymeric conductors has flourished. Within this deluge a plethora of other polymers have been shown to be capable of metal-like conductivity upon similar treatment.

Chemically, the transformation of a semiconductor, fully conjugated polymer (such as polyacetylene) to a metal-like conductor is believed to be a simple electronic oxidation or reduction reaction. The reductive process is shown schematically in Reaction I for polyacetylene and an electron donor as the dopant. The resulting electrically conductive material is apparently based on an extended delocalized carbonionic structural unit. Our research is based on an alternative chemistry to an equivalent delocalized carbonionic structure, as shown in reaction II.

Proton abstraction from relatively acidic doubly allylic and/or benzylic methylene units is facile. The utility of strong base chemistry for the preparation of electrically conductive materials was first demonstrated through the synthesis of poly(p-phenylene pentadienylene) and its "doping" with n-BuLi. Tolbert et al. have also demonstrated proton abstraction doping for the preparation of doped polyacetylene.

In this work we would like to present further studies on the utility of proton abstraction doping for the preparation of organic conductors, concentrating on the synthesis and properties of low molecular weight conductive anions.

EXPERIMENTAL

Synthetic schemes for the preparation of delocalized anions used in this study are outlined below.
Structural confirmation of the polyether was obtained from $^1$H NMR. Gel permeation chromatography of the material indicated a polystyrene equivalent molecular weight of 2000amu. Treatment of a THF solution of the above polyether with n-BuLi yielded a deep blue solution, apparently indicating anion formation. However, the color began to dissipate within 5mins, presumably due to cleavage of the labile benzyl ether linkage. Our current synthetic target is compound E, which should eliminate this concern.

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\text{E} \quad \text{CH}_2\text{CH}_2\text{CH} = \text{CH}_2 - \text{OH}
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ACKNOWLEDGEMENT

The authors wish to thank the Office of Naval Research for their generous support of this project.

REFERENCES

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