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ROLE OF POLYMERS IN MATERIALS SCIENCE

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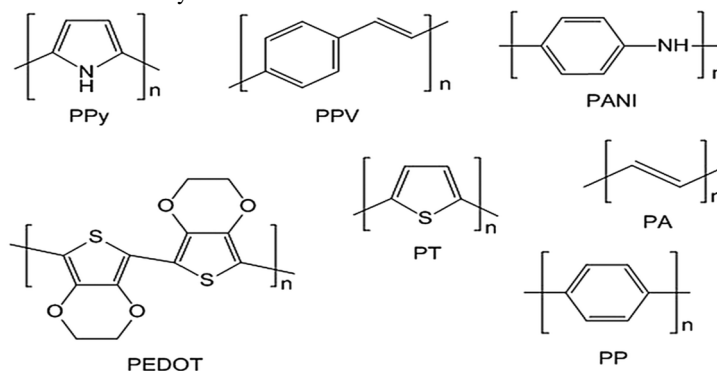
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ABSTRACT

Conjugated polymers play an important role in materials science and are used in organic light-emitting diodes (OLEDs), solar cells, photovoltaic devices, field effect transistors and lasers. While poly(acetylene) prepared from alkynes have found limited applications due to their reduced stability and proneness to oxidation, poly(acetylene) derived from the cyclopolymerization of heptadienes possess a conjugated backbone incorporated into cyclic structures, thus providing enhanced stability and processability. We hereby report the living stereo- and regioselective cyclopolymerization of selected heptadienes by various Mo-derived Schrock catalysts and were able to extend this chemistry to Ru-based Metathesis catalysts.



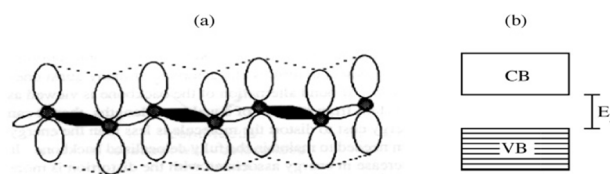
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INTRODUCTION

The shape-memory materials exhibit some novel performances, such as sensing (thermal, stress or field), large-stroke actuation, high damping, adaptive responses, shape memory and superelasticity capability, which can be utilized in various engineering approaches to smart systems.

Based on an extensive study, the various shape-memory materials are designed, with special attention to the recently developed or emerged materials.

The basic phenomena in the materials, is the stimulus-induced phase transformations which result in the unique performance and govern the remarkable changes in properties of the materials. Conjugated polymers are beginning to find uses, in both the neutral and the doped states, in prototype molecular-



based electronics applications and in electronic and opto-electronic devices.

Emphasis is placed on the interconnections of the electronic, geometric and chemical structures, in the ground state and especially in the excited states. The important role of electron and electron lattice interactions are pointed out, and justified through a combined experimental theoretical approach. Conventional polymers, plastics have been used traditionally because of their attractive chemical, mechanical, and electrically insulating properties, and

not for their electronic properties. Although the idea of using polymers for their electrically conducting properties dates back at least to the 1960s the use of organic n-conjugated polymers as electronic materials in molecular-based electronics is relatively new. While behaving as insulators or semiconductors in the pristine form, conjugated polymers can reach metallic-like electrical conductivity when doped. Since 1977, the dream of combining the processing and mechanical properties of polymers with the electrical and optical properties of metals has driven both the science and technology of conducting polymers.

USES

A central issue in the physics of these n-conjugated polymers (and the corresponding oligomers) is the strong coupling between the electronic structure, the geometric structure, and the chemical structure, that is, the bonding pattern of the atoms in the molecular system. In the 1980s, the concepts of polarons, bipolarons, and solitons were developed, in the context of both transport properties and optical properties. In fact, in the case of polymer-based LEDs, the development of device structures has led to the establishment of hi-tech companies, as well as development programs within large industries, in at least a dozen countries around the world, focused mainly, but not exclusively, on a variety of display-type applications.

During the past few years, the perception of the nature of the physical basis of the unique electronic properties of conjugated polymers, both as isolated

molecules and as molecular solids, has developed to a somewhat more sophisticated level of understanding. In addition to the exploitation of the high electrical conductivities, e.g., in the manufacture of conducting transparent plastics and conducting fabrics, the fast and high non-linear (both second-order and third-order) optical response displayed by conjugated organic compounds is also a topic of major interest. More recently, conjugated polymers are finding use in perhaps the area of highest activity to date for these materials, that of electronic applications. In particular, conjugated polymers as well as n-conjugated oligomers play a central role in organic-based transistors and integrated circuits, photovoltaic devices and especially in organic-based light emitting devices. Even solid-state lasers are under development.

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