The Synthesis, Physical Properties, Bioactivity and Potential Applications of Polyanilines

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By

Marija Gizdavic-Nikolaidis,
Graham Bowmaker and Zoran Zujovic

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PREFACE

Electrically conducting polymers (CPs) are advanced materials which exhibit the electrical and optical properties of metals, whilst retaining the attractive mechanical properties and processing advantageous of polymers. These characteristics make CPs of great importance for fundamental science and offer possibilities for a wide variety applications in industry, *e.g.* as gas sensors, biosensors, actuators/artificial muscles, materials for anticorrosive coatings, and electronic devices. This is one area of polymer science that has probably seen the most dramatic advances recently.

This book is intended to provide an overview of the latest research developments and new techniques for preparation of polyanilines (PANI) and to offer the unique opportunity for readers in one place to explore exciting recent developments in applied research on nanostructured PANIs and functionalised polyanilines (fPANIs). The book is written for a wider scientific/industry readership: scholars, researchers, technologists, and students at all academic levels concerned with CPs and the exciting world of their applications.

The first chapter presents a concise introduction to PANI: its structure, charge storage, mechanism of conduction and standard methods of synthesis. The second chapter is dedicated to fPANIs. The competitive advantages of using PANI based CP include their facile and inexpensive synthesis, thermal stability to up to 300 ^{o}C, and their non-leaching property. The use of PANI for industrial applications is, however, often limited because of its insolubility in common solvents, thereby making it difficult to process. The insolubility of PANI can be circumvented to some extent, by copolymerising aniline with substituted anilines that impart solubility to the resulting fPANI. fPANIs are soluble in basic aqueous media, and in polar solvents such as *N*-methyl-2-pyrrolidone (NMP) and dimethyl sulfoxide (DMSO).

Nanofibres of PANI in particular have attracted great interest because of their properties which may enable them to find applications in sensors, batteries, molecular electronic devices, and as corrosion inhibitors and separation membranes. While various synthesis methods have been established, preparation of one-dimensional nanostructured PANI with controllable sizes and morphologies on a large scale is still a major challenge. Therefore, the third chapter deals with the synthesis of PANI with specific nanostructured morphologies. An overview of formation