Materials Science Forum Vol. 555 (2007) pp. 503-508
online at http://www.scientific.net

Synthesis and Characterization of Polyacriflavine

B. Marjanović[1,a], G. Ćirić-Marjanović[2], A. Radulović[3], I. Juranić[4] and P. Holler[5]

[1]Centrohem, Karadjordjeva 129, 22300 Stara Pazova, Serbia

[2]Faculty of Physical Chemistry, University of Belgrade, Studentski trg 12-16, 11001 Belgrade, Serbia

[3]Institute of General and Physical Chemistry, Studentski Trg 12-16, 11001 Belgrade, Serbia

[4]Faculty of Chemistry, University of Belgrade, Studentski trg 12-16, 11001 Belgrade, Serbia

[5]Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, Heyrovský Sq. 2, 162 06 Prague 6, Czech Republic

[a]cenhem@verat.net

Keywords: Chemical oxidative polymerization, Coupling reactions, MNDO-PM3, Molecular structure, Morphology, Polyacriflavine, Semiconducting polymer.

Abstract. New functional polymeric, semiconducting materials were synthesized by chemical oxidative polymerization of acriflavine hydrochloride in aqueous solution at room temperature, using ammonium peroxydisulfate as an oxidant. Polymerization products were characterized by gel-permeation chromatography (GPC), FTIR spectroscopy, scanning electron microscopy (SEM) and conductivity measurements. The influence of the oxidant/monomer molar ratio on the molecular structure, molecular weight distribution and the electrical conductivity of polyacriflavines was studied. Molecular weights approach a maximum value of ~20000. The polyacriflavine prepared by using oxidant/monomer molar ratio 1.25 shows the conductivity of 2.8×10^{-7} S cm^{-1}. New substitution pattern shown by FTIR spectroscopic analysis combined with MNDO-PM3 semi-empirical quantum chemical calculations revealed N─C2 coupling reactions as dominant. The formation of phenazine rings in ladder structured polymerization products was observed by FTIR spectroscopy. The existence of a certain polyacriflavine crystalline structure was suggested from the SEM micrographs.

Introduction

The creation of aromatic diamine polymers by oxidative polymerizations is one of the latest advances in the field of conducting polymers [1]. Aromatic diamine polymers have a lot of novel functions compared with polyaniline and polypyrrole, such as changeable electroactivity, high permselectivity to various electroactive species, unique electrochromism, linear sensitivity of conductivity to moisture, regular variation in conductivity with temperature and external electric field, high sensibilities of the polymer-modified electrode to biosubstances at an extremely low concentration, good detecting ability of electroinactive anions, pronounced electrocatalytic properties, effective absorptivity to heavy metal ions, anticorrosion ability, strong adhesion to metal, and high capacitance.

As a continuation of our recent study devoted to aromatic diamine polymers [2], we have focused our attention on the known fluorescent dye acriflavine hydrochloride, antiseptic agent for skin and mucous membranes, as a promising aromatic diamine monomer. To our best knowledge, as in the case of most of the polymers of aromatic diamines, which have been prepared mainly by electrochemical polymerization [1], there is no report on the chemical oxidative preparation of polyacriflavine. The aim of the present work was to investigate the possibility of acriflavine hydrochloride polymerization in aqueous solution by standard chemical oxidation route, and to study the influence of the oxidant/monomer molar ratio on the molecular-weight distribution, molecular structure and conductivity of obtained novel polymeric materials. Particular attention was