

*Doctoral Dissertation Abstract*

*Przemysław Ledwoń MSc*

*The study of the electrochemical and spectroelectrochemical properties of meta-substituted arylbenzenes*

Doctoral dissertation prepared and written under the supervision of prof. Mieczysław Łapkowski at the Faculty of Chemistry, Silesian University of Technology.

The doctoral dissertation consists of two parts. The first part includes literature review, a description of experimental techniques and a summary of the results. The second part consists of three original articles published in international peer-reviewed journals and two manuscripts, which are currently the subject to review in international journals.

The foremost objective of this doctoral dissertation is the identification of the electrochemical and spectroelectrochemical characteristics of new synthesised star-shaped monomers and their branched polymers. The thesis is based on the fundamental research aimed at a determination of the effect of the structure of monomers on their properties and properties of their conjugated polymers.

The basic compounds are based on a benzene or 1,3,5-triazine core and different heterocyclic groups substituted in meta position. Detailed objectives include the determination of the effect of the heterocycles and additional methoxyl or hydroxyl groups substituted into the benzene core on the properties of monomers and their polymers.

Studied materials were characterized by cyclic voltammetry and combined electrochemical and spectroscopic techniques such as UV-vis-NIR spectroscopy, Electron Paramagnetic Resonance and Raman spectroscopy. The research affords insight into both the nature of the oxidation processes of different conjugated polymers based on star-shaped monomers and the role of meta-substitution.

In summary, the dissertation determined the influence of monomer structure on their electrochemical and spectral properties, as well as the properties of corresponding polymers. A hydroxyl group attached to the central benzene unit significantly changes the electrical and optical properties of monomers. Monomers with a hydroxyl group present lower oxidation potential and are more easily polymerized. The replacement of a benzene core by 1,3,5-triazine results in improvement of the electrochemical stability of compounds during reduction. 1,3,5-triazine stabilize radicals anions in solid state

polymers. At low doping levels, spin-bearing species are formed. After exceeding potential - termed over-reduction - a sharp deterioration in electrochemical properties takes place.