ABSTRACT

The discovery of conducting-semiconducting polymers has led to a real revolution in the optoelectronic and energy industries and technologies. In 2000 Alan MacDiarmid, Hideki Shirakawa and Alan J. Heeger were awarded the Chemistry Nobel Prize for the discovery and development of electrically conducting polymers due to their practical applications and of interdisciplinary development between chemistry and physics. Conducting Polymers are a new generation of materials that combine the electrical properties of metals and the mechanical properties of plastics.

Their low cost and easy processing, their good mechanical properties and changing of their properties, has given the opportunity to replace inorganic metals and semiconductors in many technological applications such as flexible Organic Light Emitting Diodes (OLEDs) and flexible Organic Photovoltaics (OPVs). The most important advantage following this replacement is the new potentials of applications and construction methods. They can be constructed easily, and cheaply with roll to roll (r2r) processes and their applications will be expanded.

The current trend is the development of such devices on flexible substrates, and the improvement of the properties of conducting-semiconducting polymers. The present thesis has the aim to study the deposition of thin films of one widely used conducting polymer, Poly(3,4-ethylenedioxythiophene) poly(styrenesulfonate) (PEDOT:PSS), on PET substrates and their optical structural and surface properties.

The current thesis is constituted of two parts. The first part is the theoretical part and is divided in three chapters. In the first chapter the basic principal functions of OLEDs and OPVs are mentioned and an introduction to conjugated polymers and their properties with focus on PEDOT:PSS follows. In Chapter two we describe the Spin Coating technique that was used for the deposition of thin films. Finally, chapter three sets out the theoretical background of the experimental techniques that were used in this thesis.

The second Part is the experimental part and it consists of three chapters. In chapter four a detailed study of the deposition of PEDOT:PSS thin films by spin coating technique is presented as well as the optical properties of different types of PEDOT:PSS films. Fifth Chapter is focused on the surface treatment of PET substrates by UV

irradiation in order to deposit PEDOT:PSS thin films on it. The changes of the optical and surface properties of the treated substrates and deposited thin films are investigated. Finally in the sixth chapter DMF solvent is added to the PEDOT:PSS solution, as secondary dopant in order to achieve conductivity enhancement of thin films deposited from that solution. The mechanism of conductivity enhancement is studied by investigating the changes in optical and surface properties of the thin films.