

Αγγλική Περίληψη

This thesis is a study carried out as part of the Postgraduate Program of the Aristotle University of Thessaloniki “Nanosciences and Nanotechnologies”. It is based on materials physics at the nanoscale and was intended to improve the electrical characteristics of organic solar cells by exploitation of the plasmon properties of noble metal nanoparticles. Initially, it deals with the optimization of the chemical synthesis parameters of silver nanoparticles in order to occur nanostructures suitable for incorporation into the polymeric hole transport layer (HTL) of organic photovoltaic devices (PEDOT:PSS) and on benefit with local surface plasmon resonance (LSPR). The optical properties and size distribution of the silver nanoparticles are checked via spectroscopy and microscopy techniques. In the second stage, we tested commercially available colloidal solutions of silver and gold nanoparticles of known size distribution, and silver nanoparticles formed by laser ablation, except apart from the laboratory synthesized nanoparticles. All approaches are performed in lab scale photovoltaic devices of normal and inverted structure, always using the photoactive layer of the following semiconductors: the organic polymer / electron donor P3HT (Poly(3-hexylthiophene)) and the fullerene derivative PC60BM ([6,6]-phenyl-C61-butyric acid methyl ester). Finally, the nanoparticles that offer the highest enhancement are incorporated in a printed flexible photovoltaic device, the structure of which has the potential to be transferred to larger scale organic photovoltaics.