Surface modification and characterization of conductive nanostructured PEDOT:PSS thin films

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Abstract

Poly(3,4-ethylenedioxythiophene): poly(styrenesulfonate) (PEDOT:PSS) has emerged to be one the most promising flexible electrode materials over rigid metallic oxides. This conducting polymer finds applications in many electric devices, such as OSCs, nanotransistors, supercapacitors, OLED, LCD, and wearable electronics [1]. In the past few years, many studies have been focused on the improvement and tuning of PEDOT:PSS electric and mechanical properties, by acting on its composition and/or surface structure[2]. In our present work, we investigated the formation of surface nanostructures on PEDOT:PSS thin films surfaces, after treatment with different low boiling point solvents. The thin films were obtained by spin coating polymer solutions on ITO substrates. Afterwards, the obtained samples were solvent treated by different methods, as spin coating a drop of pure solvent on top, solvent washing, and solvent vapour annealing. We studied the solvent treated PEDOT:PSS thin films by a combination of macroscopic and microscopic techniques. In particular, we evaluated the resulting structures by four-point probe, contact angle, and Atomic Force Microscopy (AFM). AFM was used not only to evaluate the surface structures, but also to obtain mechanical and electrical properties. We observed that different PEDOT:PSS nanostructures were formed depending on the solvent nature and treatment procedure, with distinct physico-chemical properties. We discuss our results by considering the possible disposition of the PEDOT and PSS phases in the material before and after solvent treatment, since the nanostructured phase morphology will then affect significantly the polymeric layer characteristics [3,4].

References

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