Surface plasma treatment of PEDOT-TiO2composite materials and its applying to electrode in various devices

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During the last decades, polymers withhighly extended p-electrons have attracted much attention because of their goodconductivity and easy in band-gap/colour-tuning via structural control. PEDOTfound several applications including antistatic coatings for photographicfilms, hole transport layers for light-emitting diodes, photovoltaic devices,organic thin film transistors, and sensors. Moreover, PEDOT variousbioengineering applications such as biosensors, drug-releasing process andbioactuators due to its low structural defects, high aqueous stability andbiocompability were reported. The nano-hybrid/conducting polymer compositeshave become an area of research for scientists during the past decade. Amongthe used nanomaterials to prepare the hybrid polymer composites, TiO2 is one ofthe most investigated oxide semiconducting materials due to low cost,non-toxicity, and very good stability. TiO2 finds a wide range of applicationssuch as environmental cleaning, photocatalysts, photosplitting water, dye-sensitizedsolar cells, photochromic devices and gas sensing.

In this research, PEDOT-TiO2 compositefilms were prepared by a simple mechanical mixture of TiO2 and PEDOT:PSS undermechanical stirring, which was demonstrated to deliver an effectively combinednetwork of both high electrical conductivity and superior electrocatalyticactivity. The composite films have been explored as an alternative for thecounter electrodes of dye-sensitized solar cells and scafford of SAW sensor. Itwas manifested that plasma treated PEDOT-TiO2 composite films displayedexcellent performance comparable to Pt counter electrode in DSSCs due to thecombined network endowing more favorable and efficient interfacial activesites. Consequently, plasma treated PEDOT-TiO2 composite films exhibit a Jsc of10.93 mA/cm2, a Voc of 0.74 V and a fill factor (FF) of 0.67 with an overallconversion efficiency of 5.84%. This result showed increasing of 15%electrocatalytic activity using plasma treated PEDOT-TiO2 composite counterelectrode.