High-Throughput Electrosynthesis of Gradient Conducting Polymer Films Using a Single-Electrode Electrochemical System

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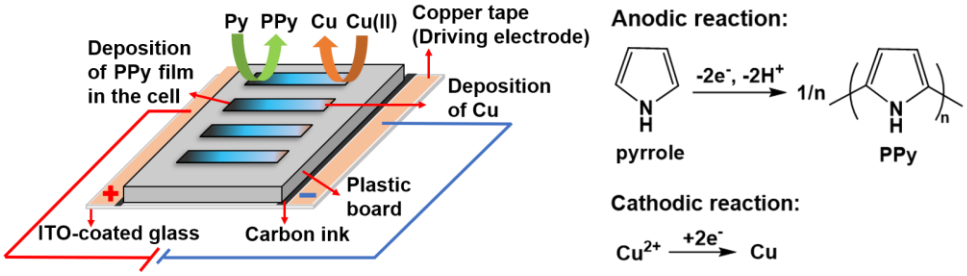
As an effective approach for materials synthesis, bipolar electrochemistry has been earning a renewed interest nowadays thanks to its unique features compared to conventional electrochemistry. Indeed, the wireless mode of electrode reactions and the generation of a gradient potential distribution above the bipolar electrode (BPE) are among the most appealing features of bipolar electrochemistry. In particular, the gradient potential distribution is a highly attractive characteristic for the fabrication of surfaces with gradients in their chemical properties or molecular functionalities.[1] Herein, the high-throughput electropolymerization of gradient polypyrrole (PPy) films by means of a new electrochemical cell design named the Single-Electrode Electrochemical System (SEES) is reported.[2] SEESs are made by attaching an inert plastic board with holes onto an indium-tin-oxide (ITO) electrode, constructing multiple microelectrochemical cells on the same electrode.[3] This type of arrangement enables parallel electrochemical reactions to be carried out simultaneously and controlled in a contactless manner by a single electrode. Several experimental conditions for PPy film growth were extensively investigated, including the applied voltage, the electrodeposition time, the electrolyte composition, and the monomer concentration. Furthermore, the gradient property of the polymer films was evaluated by thickness determination, surface morphology analysis, and contact angle measurements. The use of SEES has been demonstrated as a convenient and cost-effective strategy for high-throughput electrosynthesis applications and has opened a new door for gradient film preparation via a rapid condition screening process.



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