Preparation of Mixed Langmuir-Blodgett Films of Poly(3-hexylthiophene)/Octadecylamine/Glucose-oxidase for Glucose Sensing Applications

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For preparing glucose biosensors, octadecylamine (ODA) Langmuir monolayer has good ability in incorporating glucose oxidase (GOx), but the electronic conductivity of ODA is poor. On the contrary, poly(3-hexylthiophene) (P3HT) molecules have good electronic property, but weak interaction to the GOx. To get both advantages of the two molecules, mixed P3HT/ODA Langmuir monolayers are utilized in this work. The characteristics of the mixed P3HT/ODA Langmuir monolayers are investigated by surface pressure-area per molecule (π-A) isotherms and observed by an atomic force microscope. The Langmuir monolayers are then used as template layers to incorporate GOx, preparing P3HT/ODA/GOx LB films for glucose sensing studies. The results show that P3HT molecules tend to aggregate at the air/liquid interface and, furthermore, the P3HT monolayer has weak ability to adsorb GOx from the subphase. By using mixed P3HT/ODA monolayer, the presence of ODA not only inhibits the aggregation of P3HT, but also increases the GOx adsorption ability. The extensibility of P3HT and the homogeneity of the P3HT/ODA LB films can be controlled by adjusting the concentration of P3HT/ODA stock solutions. On the glucose sensing experiments, the performance of the P3HT/ODA/GOx LB film is greatly improved due to the presence of P3HT and, furthermore, the sensibility increases with increasing extensibility of P3HT molecules. The best sensitivity achieved for the P3HT/ODA/GOx film is 4.2 μA $cm^{-2}mM^{-1}$ which is much higher than that obtained by the ODA/GOx film (2.2 μA $cm^{-2}mM^{-1}$).

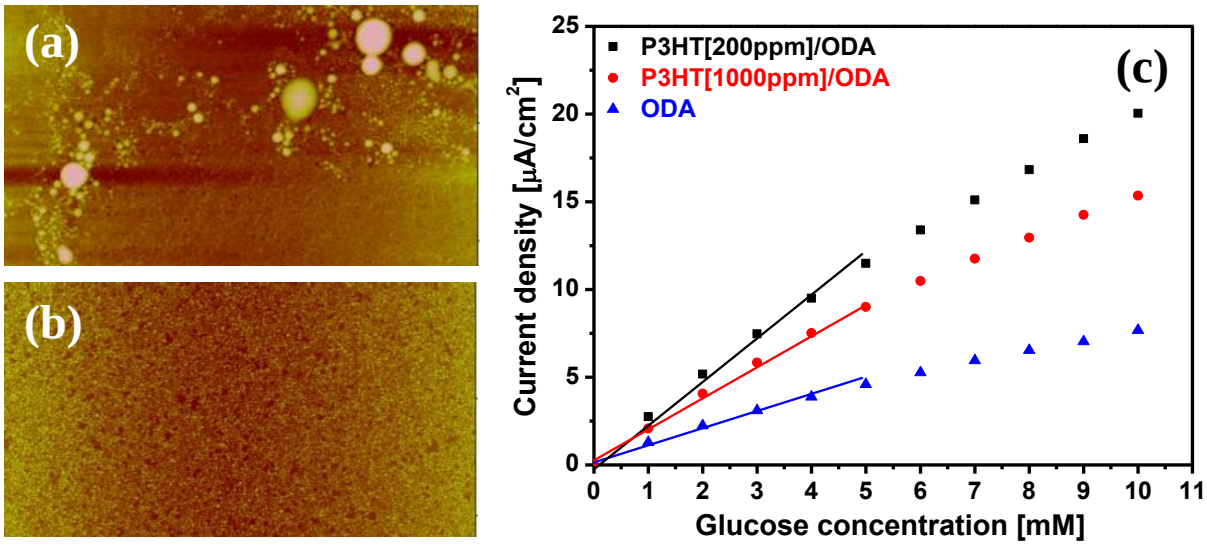

Figure 1. AFM images of P3HT (a), and P3HT/ODA (b) Langmuir-Blodgett (LB) films and, (c) the current responses measured for the LB films to a continuous injection of glucose.

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