A Novel Photoelectrochemical Sensor Based on Gr-SiNWs-Si/Pt Electrode for Sensing of Hydroquinone

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Herein, a graphene (Gr) and silicon nanowires (SiNWs) decorated n-silicon/platinum (Si/Pt) sensor was put forward to detect hydroquinone (HQ) in a photoelectrochemical (PEC) way. Platinum film was coated on the polished side of the n-silicon wafer by vacuum evaporation and SiNWs were fabricated uniformly on the other side of the wafer by electrochemical etching in a solution mixed by HF and ethanol with volume ratio 1:1 under illumination of scattered laser. The morphology and component of the SiNWs was characterized by SEM and EDS, respectively. The photoelectric properties of the SiNWs-Si/Pt were studied by semi-log current-voltage ($\log I-V$) and photoresponse measurements. Results show that the SiNWs on the Si wafer enhance the photoelectric conversion efficiency of the Si/Pt Schottky junction by about 33% relative to Si/Pt without SiNWs. Then, graphene was prepared with Hummer method and was used to decorated the SiNWs-Si/Pt wafer to build a Gr-SiNWs-Si/Pt PEC sensor. The new sensor was used to detect HQ in a two-electrode PEC way at zero bias voltage in a linear range of 10-300 μM with a detection limit of 0.3 μM (S/N=3). Excellent selectivity of the sensor to HQ in the present of catechol (CC) and other interferences was proved by anti-interference experiment.

Keywords: Photoelectrochemical; Graphene; PEC sensor; Hydroquinone; Zero bias detection

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