Supporting Information for

Ultra-Thin Optically Transparent Carbon Electrodes Produced from Layers of Adsorbed Proteins

Sarah A. Alharthi, Tomas E. Benavidez and Carlos D. Garcia

Department of Chemistry, The University of Texas at San Antonio

One UTSA Circle, San Antonio, TX 78249, USA

Electrochemical and Spectroscopic Characterization

The influence of the scan rate was investigated in the 0.005 – 0.3 V/s range and using electrochemical couples of either negative ($K_3Fe(CN)_6$) or positive charge ($Ru(NH_3)_6Cl_3$). Figure 1 shows the linear relationships between the peak current and the square root of the scan rate, obtained from representative voltammograms.

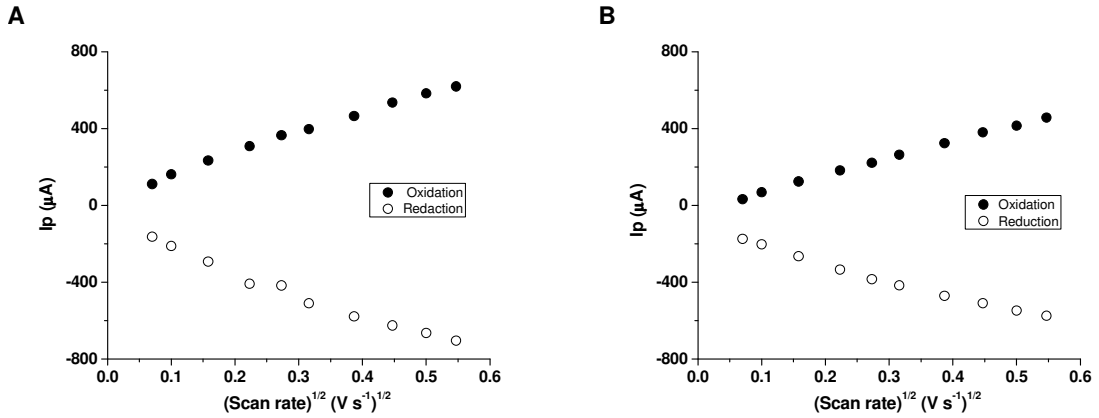

Figure 1. Dependence of the peak current (Ip) as a function of the square root of the scan rate obtained with the OTCE fabricated with 12 layers of protein adsorbed/pyrolyzed for $K_3Fe(CN)_6$ (A) and $Ru(NH_3)_6Cl_3$ (B). Conditions: 1 mM for each electrochemical couple in 0.1 M NaH_2PO_4/Na_2HPO_4 buffer + 0.1M KCl, pH = 7.4.

As it can be observed in Figure 2, significant shifts in the ΔEp were observed as the sweep rate increased.

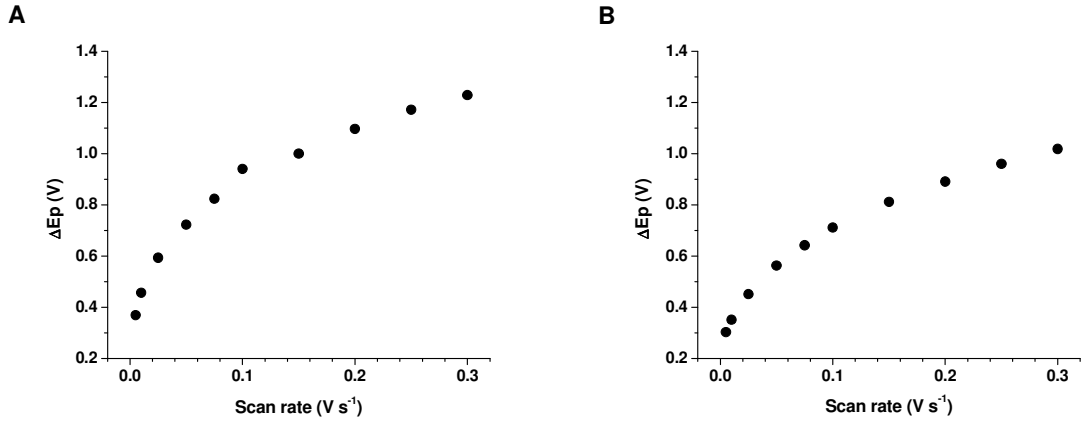

Figure 2. Dependence of the peak potential difference (ΔEp) as a function of the scan rate obtained with the OTCE fabricated with 12 layers of protein adsorbed/pyrolyzed for $K_3Fe(CN)_6$ (A) and $Ru(NH_3)_6Cl_3$ (B). Conditions: 1 mM for each electrochemical couple in 0.1 M NaH_2PO_4/Na_2HPO_4 buffer + 0.1M KCl, pH = 7.4.

The reproducibility of the proposed method was evaluated by evaluating the peak current (either anodic or cathodic wave) obtained for three electrodes, independently prepared. The results are included in Figure 3.

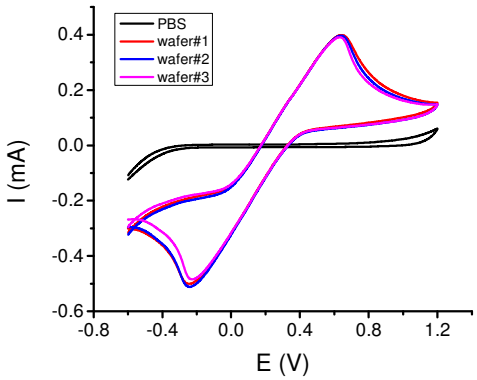

Figure 3. Electrodymanic profiles obtained with 3 electrodes fabricated with 12 layers of protein adsorbed/pyrolyzed. Conditions: 1.0 mM $K_3Fe(CN)_6$ in 0.1 M NaH_2PO_4/Na_2HPO_4 buffer + 0.1 M KCl, pH = 7.4, scan rate: 100 $mV \cdot s^{-1}$.

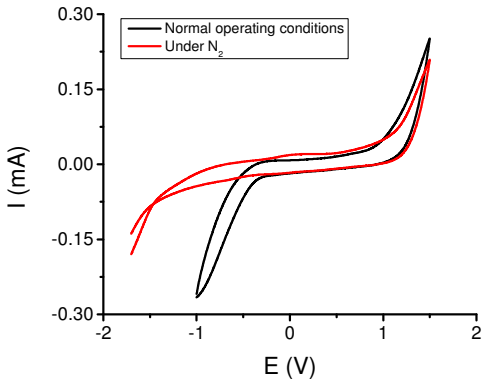

Figure 4: Electrodymanic profiles obtained with an electrode fabricated with 12 layers of protein adsorbed/pyrolyzed. Conditions: 0.1 M NaH_2PO_4/Na_2HPO_4 buffer + 0.1 M KCl, pH = 7.4, scan rate: 100 $mV \cdot s^{-1}$.

As shown in Figure 4, the operational limits of the electrode were defined between -0.5 V and 1.2 V, avoiding hydrogen and oxygen evolution (under normal operational conditions). When the CV experiments were performed in a deoxygenated solution the onset for reduction wave of oxygen was found at approximately -1.5 V. These values are in good agreement with previously reported OTCE (for example, *Anal. Chem.* 49 (1977) 1395).