

Supplementary Information

Xuan Pan¹, Kai Zhu^{2*}, Guofeng Ren¹, Nazifah Islam¹, Juliusz Warzywoda³, Zhaoyang Fan^{1*}

¹Department of Electrical and Computer Engineering and Nano Tech Center, Texas Tech University, Lubbock, Texas, 79409, USA

²Chemical and Materials Science Center, National Renewable Energy Laboratory, Golden, Colorado 80401, USA

³Materials Characterization Center, Whitacre College of Engineering, Texas Tech University, Lubbock, Texas, 79409, USA

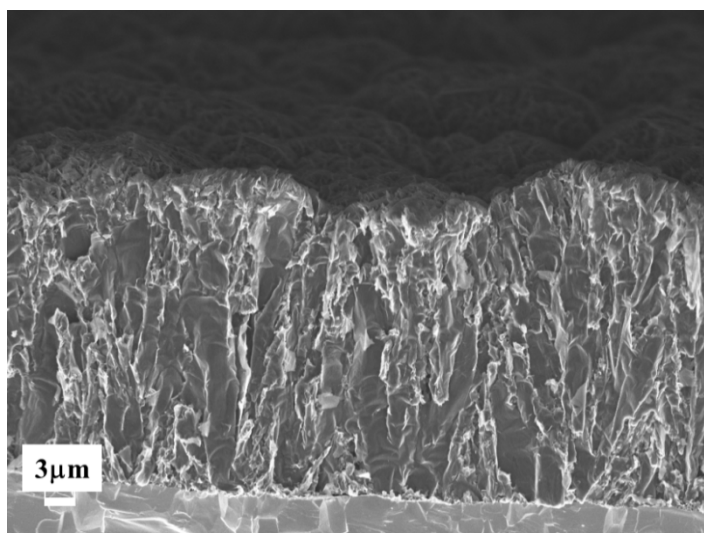


Figure S1. A representative cross-sectional SEM view of VOG (S3), indicating a thickness of ~30 μm.

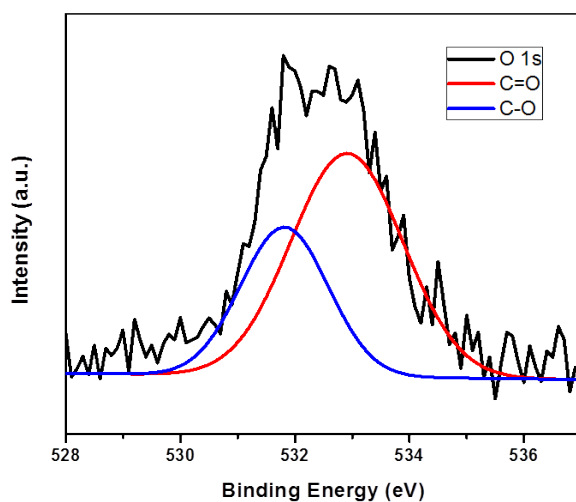


Figure S2. XPS spectrum of O 1s peak that can be fitted with C-O bond at 531.8 eV and C=O bond at 532.9 eV.

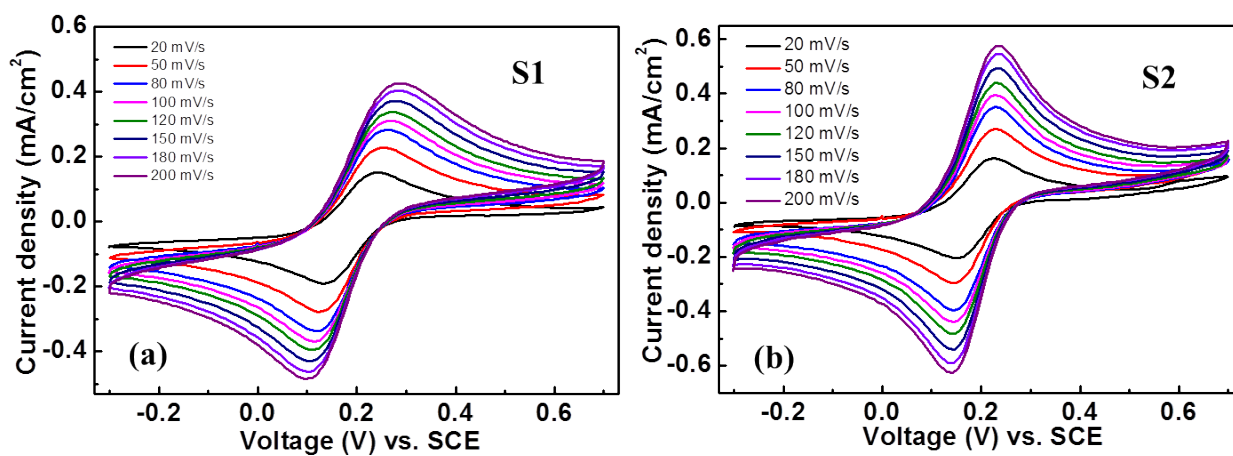


Fig. S3. The C-V profiles of samples S1 and S2 at different scan rates from 20 to 200 mV/s for $\text{Fe}(\text{CN})_6^{3-/4-}$ redox couple.

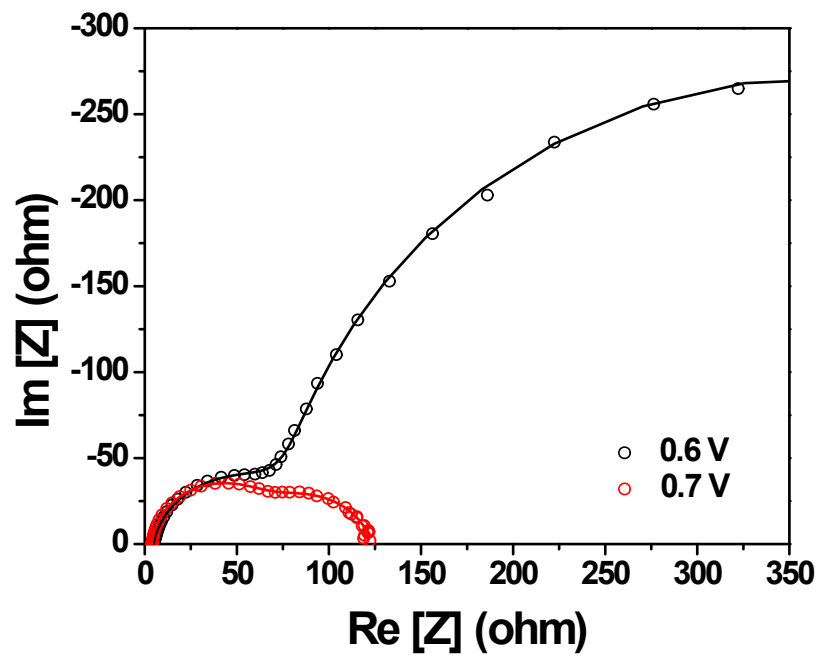


Figure S4. Typical Nyquist plots of the impedance responses for a dye-sensitized solar cell using VOG counter electrode measured at two different bias voltages.