Electrochemical Sensing of Hydrogen Peroxide Using Composite Bismuth Oxide/Bismuth Oxyselenide Nanostructures: Antagonistic Influence of Tungsten Doping

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Table S1. Oxidation and reduction peaks observed in the CV scan in the blank electrolyte (after 50 cycles).

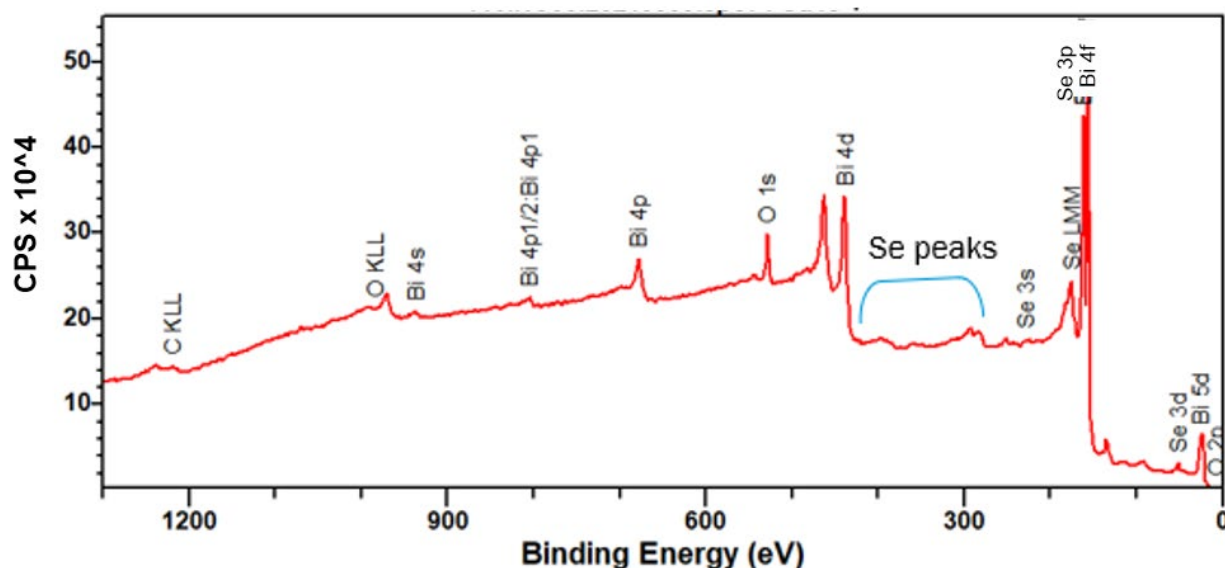| Sample	Oxidation peaks (V)	Reduction peaks (V)
$Bi_2O_xSe_y$	$+ 0.28, - 0.06, - 0.41$(broad)	$- 0.68$
2 mol% W-$Bi_2O_xSe_y$	$- 0.09, - 0.4$ (broad)	$- 0.68$
4 mol% W-$Bi_2O_xSe_y$	$- 0.07, - 0.4$ (broad)	$- 0.70$
6 mol% W-$Bi_2O_xSe_y$	$- 0.08, - 0.28$ (broad)	$- 0.75$

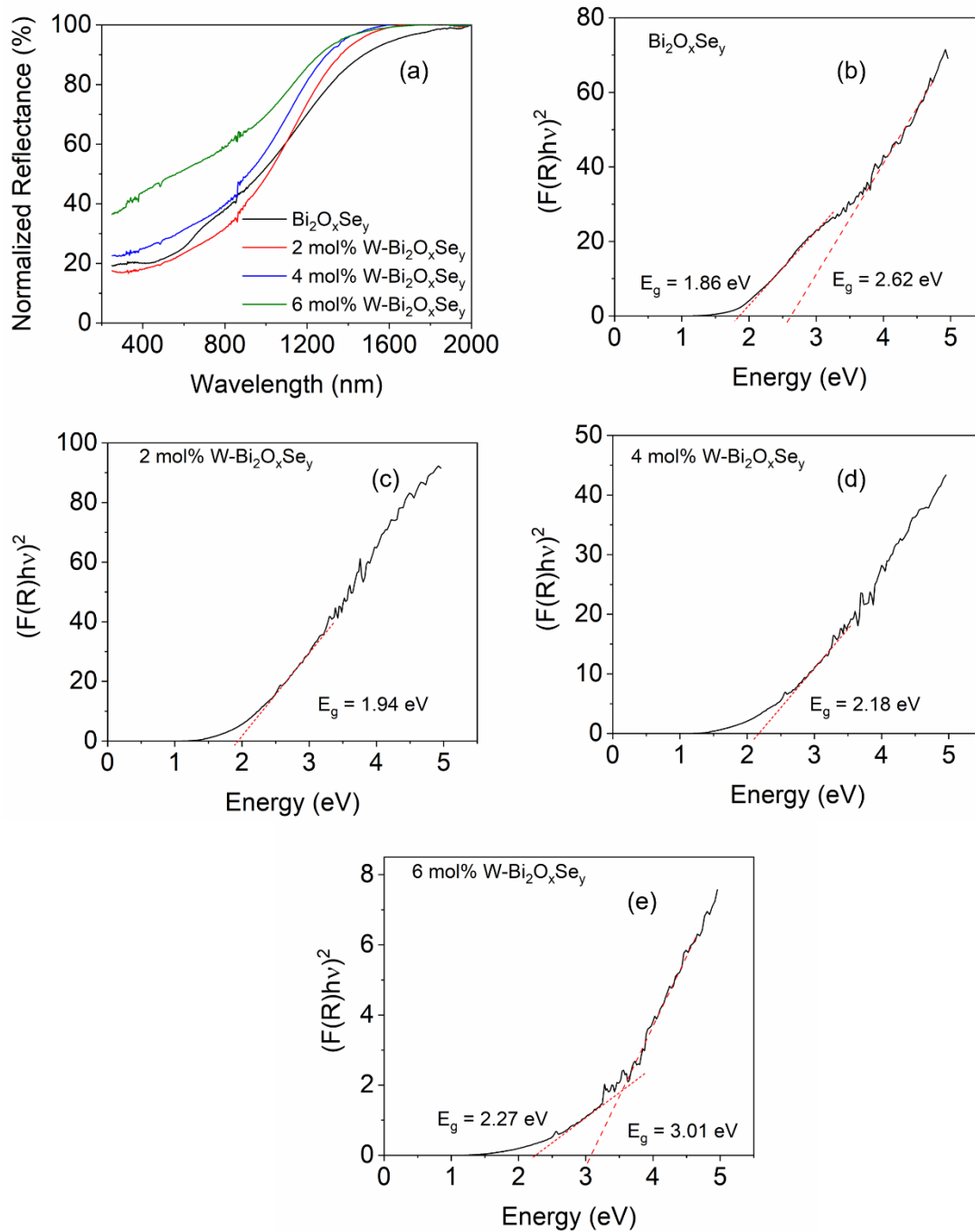**Figure S1.** Wide XPS of 4 mol% W-doped $Bi_2O_xSe_y$ sample.

Figure S2. (a) UV-Vis-NIR DRS for the samples. Tauc plots for **(b)** undoped, **(c)** 2 mol% W-doped, **(d)** 4 mol% W-doped, and **(e)** 6 mol% W-doped $Bi_2O_xSe_y$.
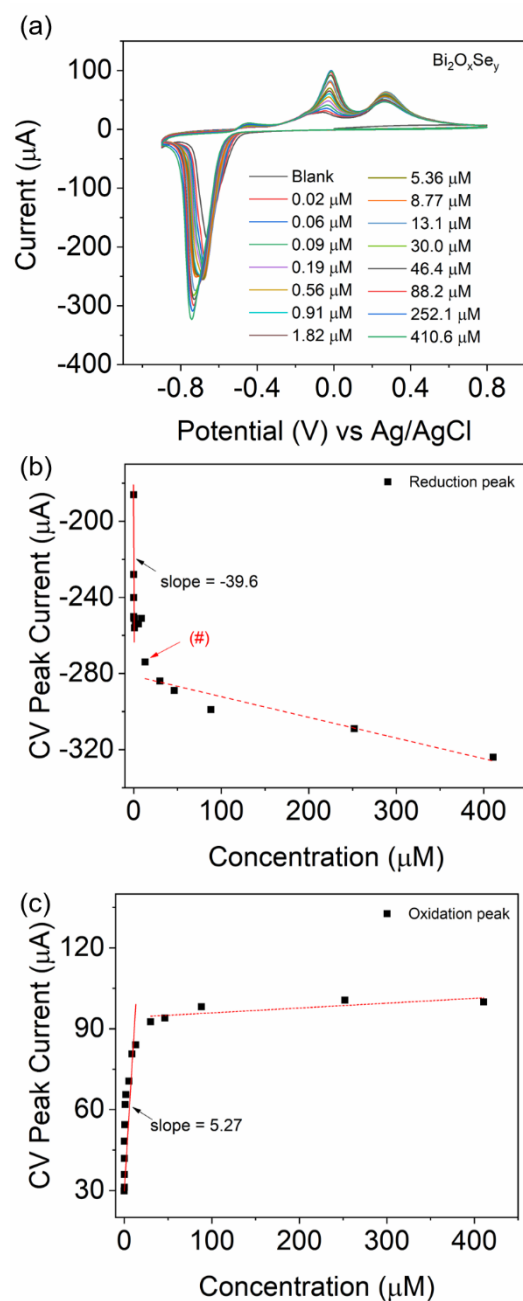
Figure S3. (a) CV scans for the Bi₂OₓSeᵧ with varying H₂O₂ concentrations (without stabilization). Linear fits for the **(b)** reduction peak and **(c)** oxidation peaks. # represents the change in the peak position from -0.66 V to -0.73 V (at 13.1 μM effective H₂O₂ concentration).
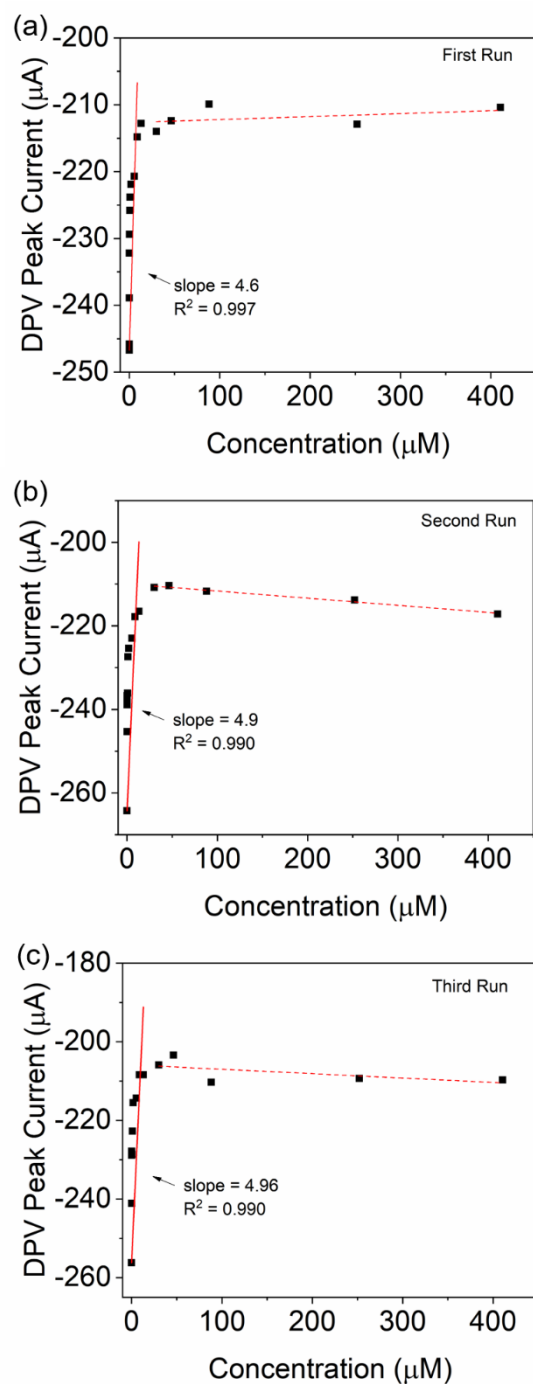
Figure S4. DPV scans for accessing repeatability of the representative Bi$_2$O$_x$Se$_y$ electrode: **(a)** first run, **(b)** second run, and **(a)** third run.

S1. Selectivity of modified glassy carbon electrode for biological applications

To evaluate the sensing performance for H_2O_2 and in the presence of other analytes, such as uric acid, NaCl, ascorbic acid (AA), and dopamine, cyclic voltammetry (CV) and differential pulse voltammetry (DPV) signals were recorded. For the selectivity tests, analytes of 10 mM concentrations (stock) were used, except for uric acid (0.4 mM stock, since it is the maximum dissolvability in water). In total, 150 μL of these stock solutions were sequentially added. The concentration of the interferant analytes (uric acid, NaCl, AA, and dopamine) was purposefully kept high to study the efficacy of the sample towards H_2O_2 detection. For the chronoamperometry (CA) study, different interfering analytes were added in the PBS solution with time intervals of 100 s, at an applied potential of -0.7 V vs Ag/AgCl.

Out of all these, the addition of H_2O_2 (and dopamine) showed a significant change in the current signal. This confirms the selectivity of the developed sensor towards H_2O_2. The corresponding CV, DPV, and CA test results are provided in Fig. S5(a-c). Although we observe a signal change in the CA for the addition of dopamine also, the CV and DPV results clearly distinguish that the material is actually more selective for H_2O_2. The observation of some peaks in the DPV around 0 V represents the sensitivity towards dopamine. The change in peak intensity around -0.7 V with dopamine can be a result of changes to the active material's surface oxidation state.
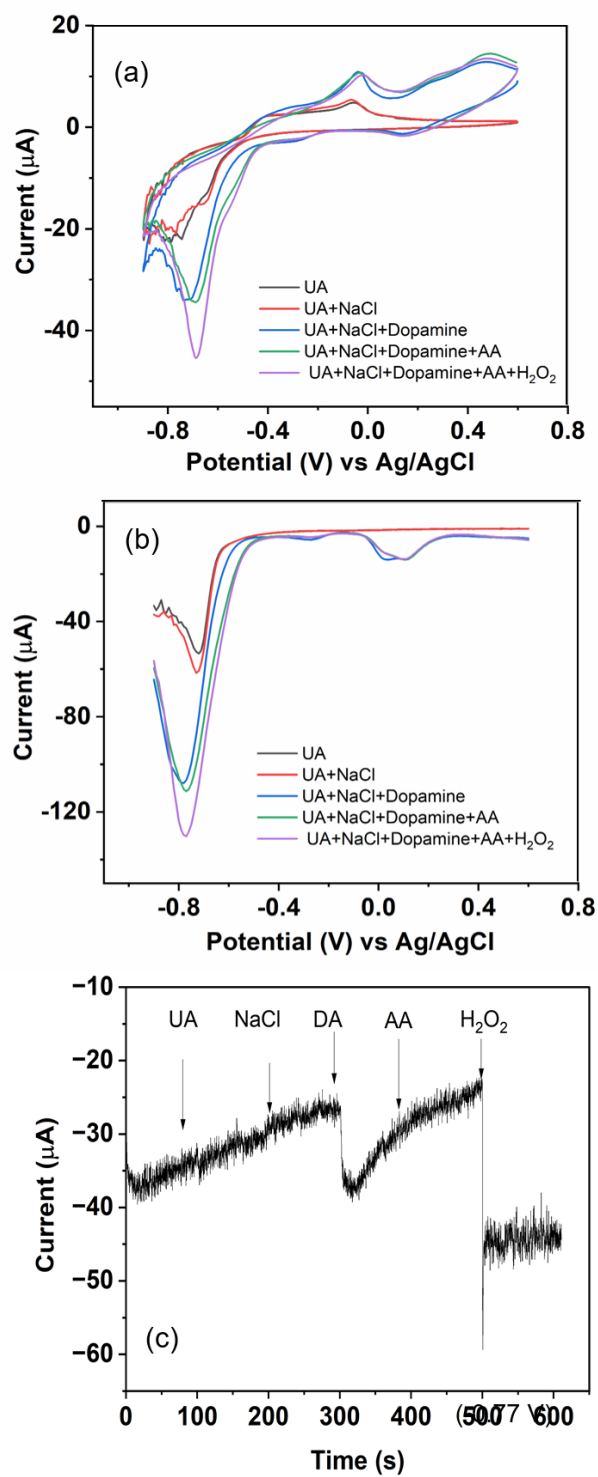
Figure S5. (a) CV and (b) DPV of 4 mol% W-Bi$_2$O$_x$Se$_y$ with different analytes. (a) CA response of 4 mol% W- Bi$_2$O$_x$Se$_y$.