PCCP

Supporting Information

Incorporation of Mo and W into Nanostructured $BiVO_4$ Films to Improve Photoelectrochemical Water Oxidation Performance

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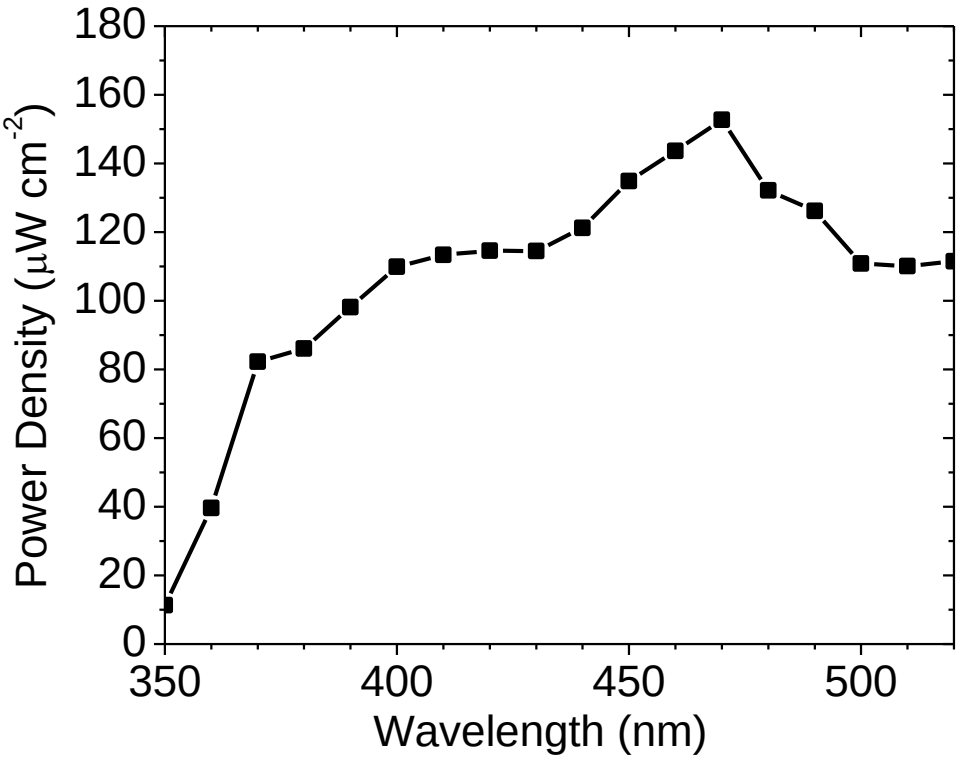

Figure S1. Typical power density spectrum for light that was incident on the film during IPCE measurements. The power was measured using a UV enhanced silicon photo-detector.

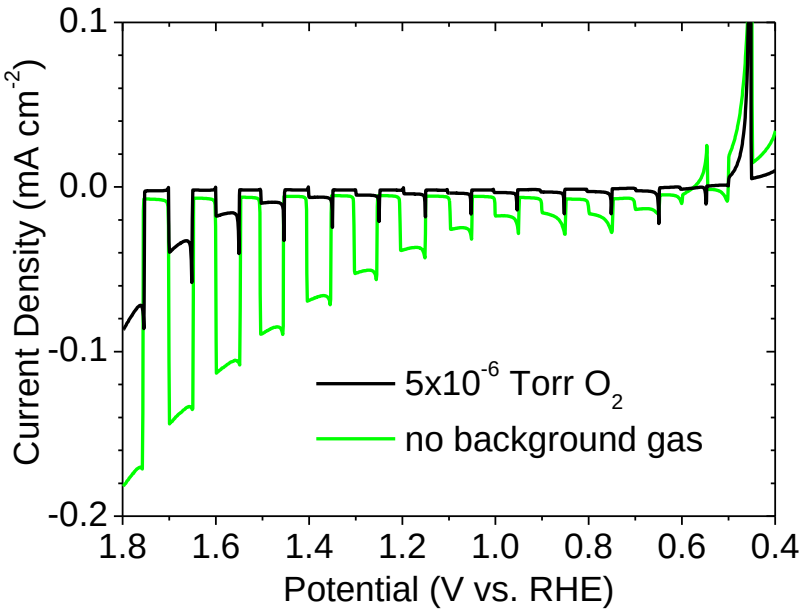

Figure S2. Chopped (dark and white light) LSV scans for $BiVO_4$ films deposited in vacuum with no background gas and with $5x10^{-6}$ Torr of O_2. After deposition both films were annealed in air at 500°C in for 2 hours. Measurements were conducted in mixture of 0.1 M Na_2SO_4 and 0.1 M phosphate buffer solution (pH 6.8) with a scan rate of 0.025 V s^{-1}.

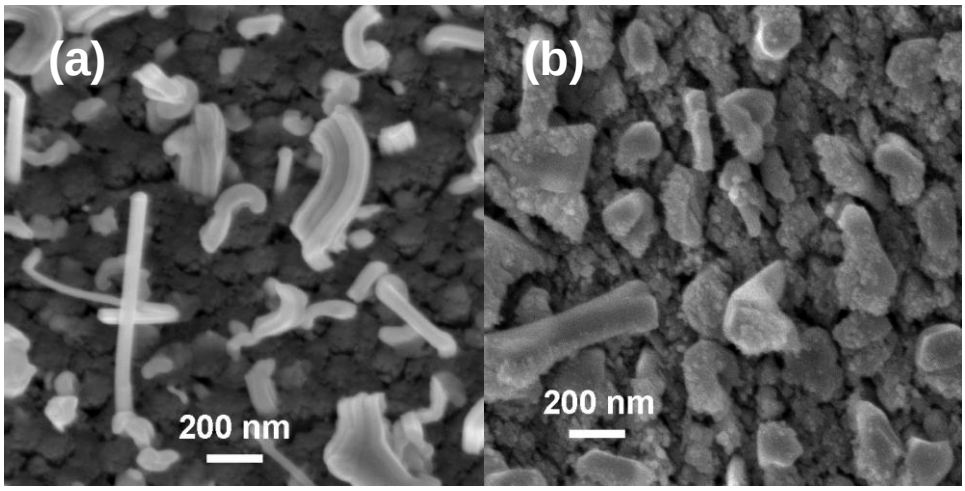

Figure S3. SEM images of films with a Bi:V:Mo:W atomic ratio of 50:50:0:0 deposited at $\gamma=55^{o}$ (a) in vacuum with no background gas and (b) with $5x10^{-6}$ Torr of O_2. The films have not been annealed.

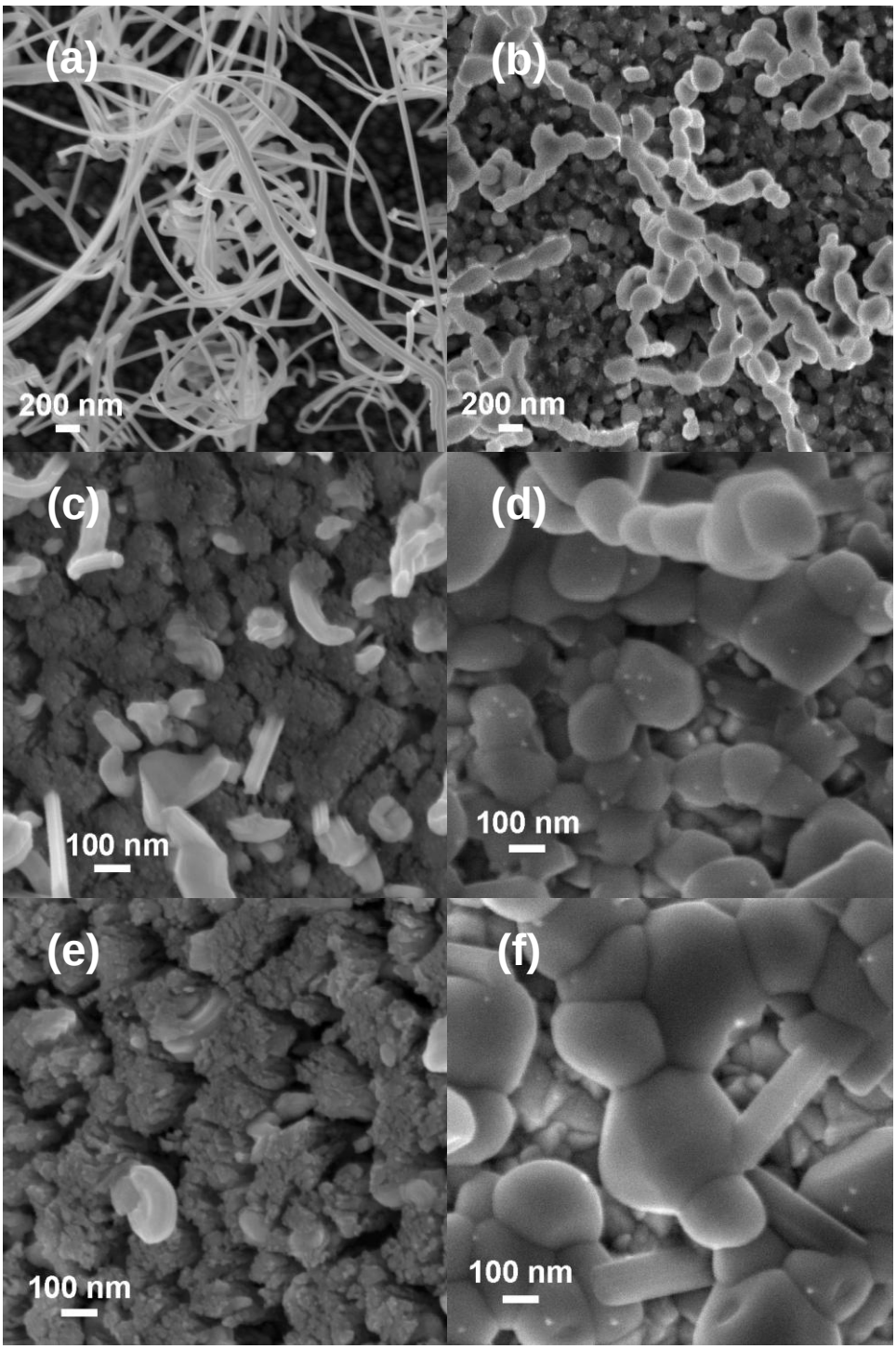

Figure S4. SEM images of films with Bi:V:Mo:W atomic ratios of 46:46:6:2 deposited in vacuum at different deposition angles (γ) taken before and after annealing in air at 500 ^{o}C for 2 hours: (a) γ=0^{o}, before annealing (b) γ=0^{o}, after annealing (c) γ=55^{o}, before annealing (d) γ=55^{o}, after annealing (e) γ=75^{o}, before annealing (f) γ=75^{o}, after annealing.

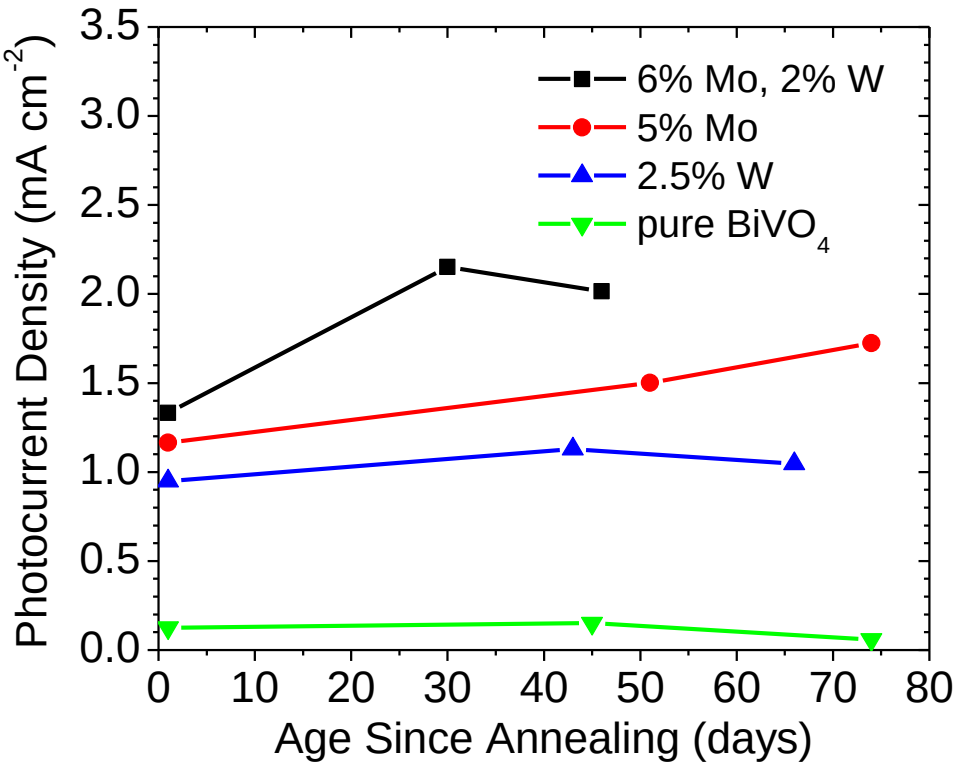

Figure S5. Trends showing improvement in photocurrent density with age since annealing for $BiVO_4$ films with varying atomic percentages of Mo and W (relative to the total Bi, V, Mo, and W). The photocurrent density values were taken from LSV scans (value at 1.6 V vs. RHE) in 0.1 M Na_2SO_4 and 0.1 M phosphate buffer solution (pH 6.8) with a scan rate of 0.025 V s^{-1}. Between measurements the films were simply left in plastic container in the laboratory at normal atmospheric conditions.

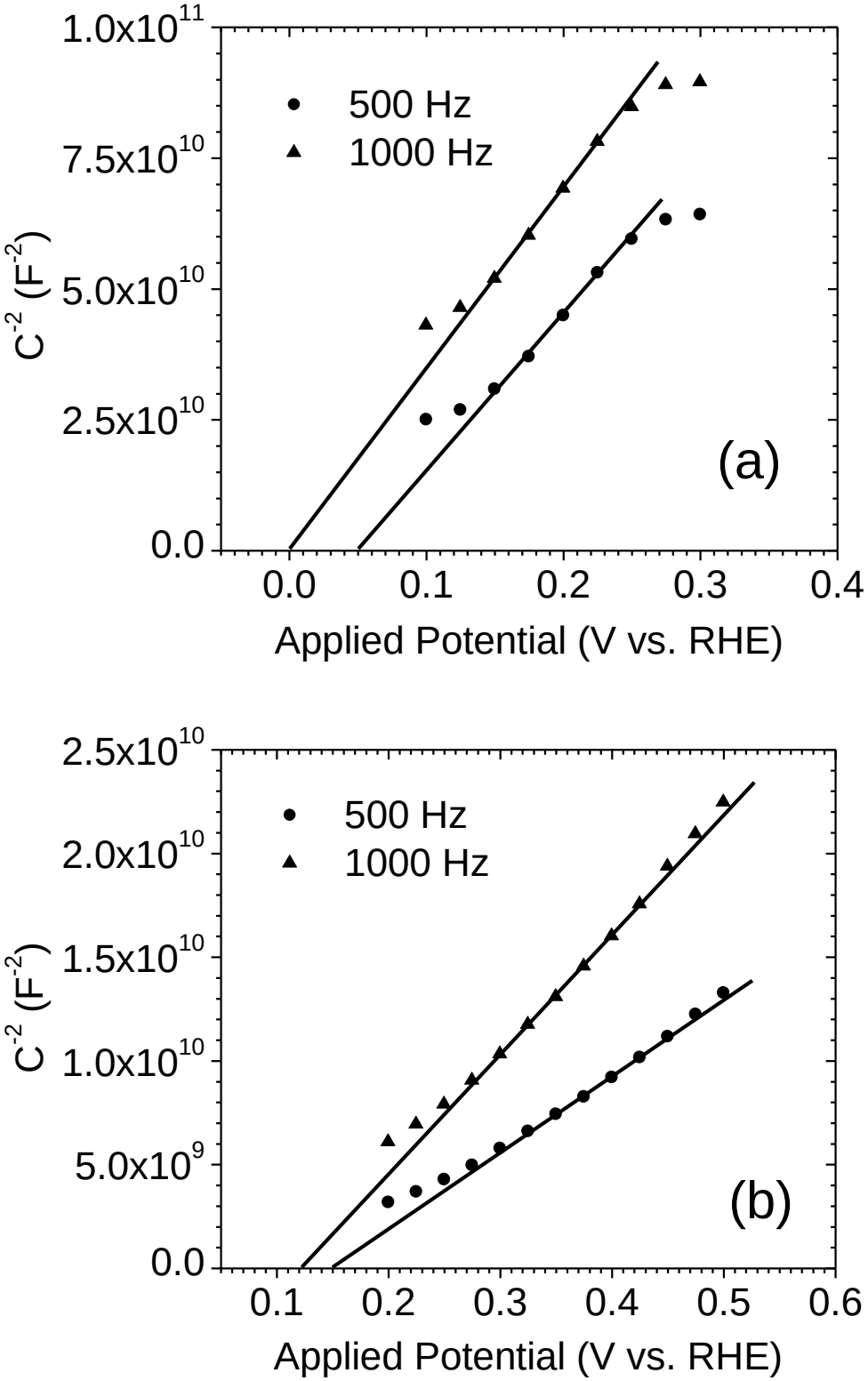

Figure S6. Mott-Schottky plot for (a) pure $BiVO_4$ and (b) 6% Mo, 2% W $BiVO_4$ films conducted in 0.1 M Na_2SO_4 and 0.1 M

phosphate buffer solution (pH 6.8).

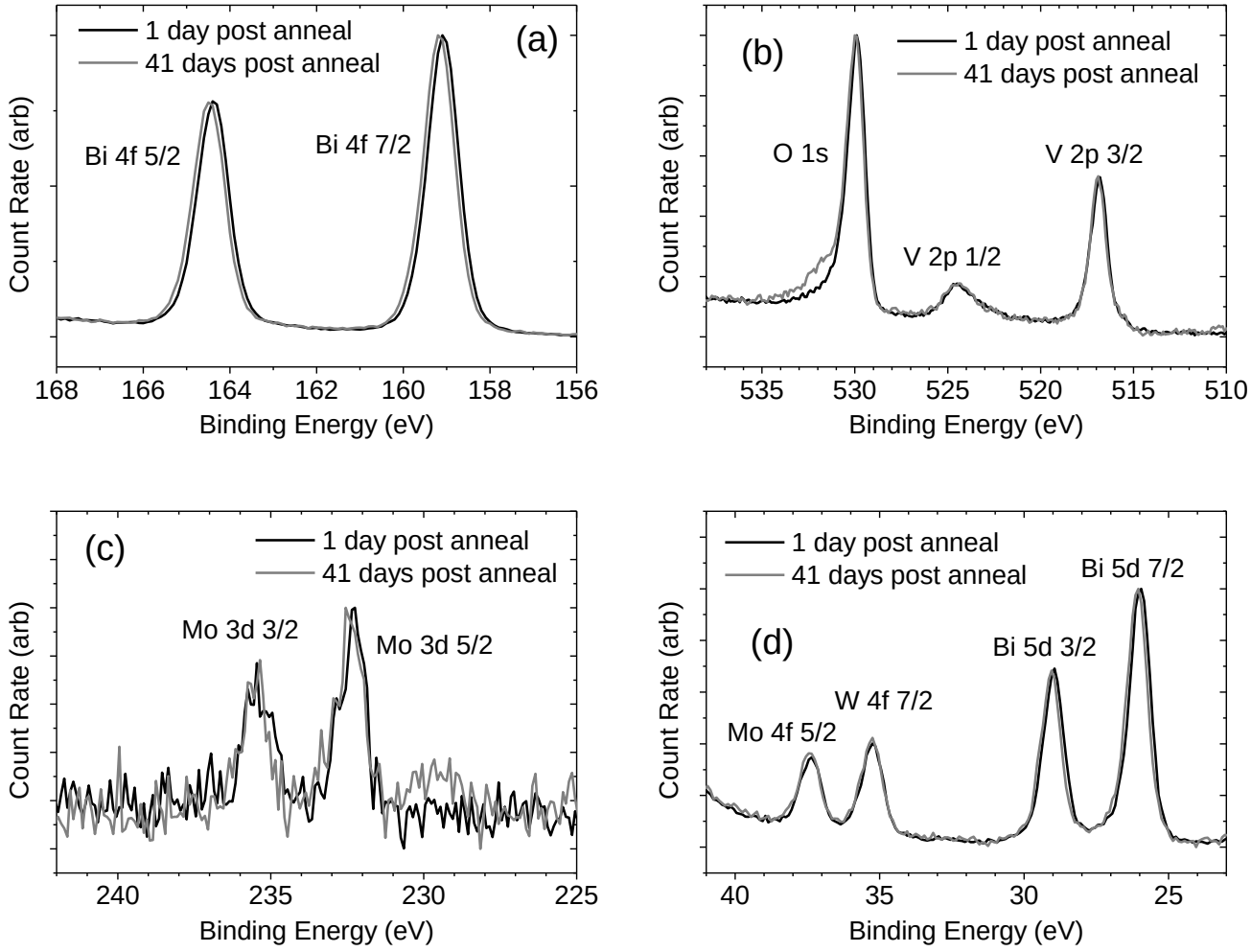

Figure S7. XPS spectra for a single 6% Mo, 2% W $BiVO_4$ film taken 1 day and 41 days after annealing.

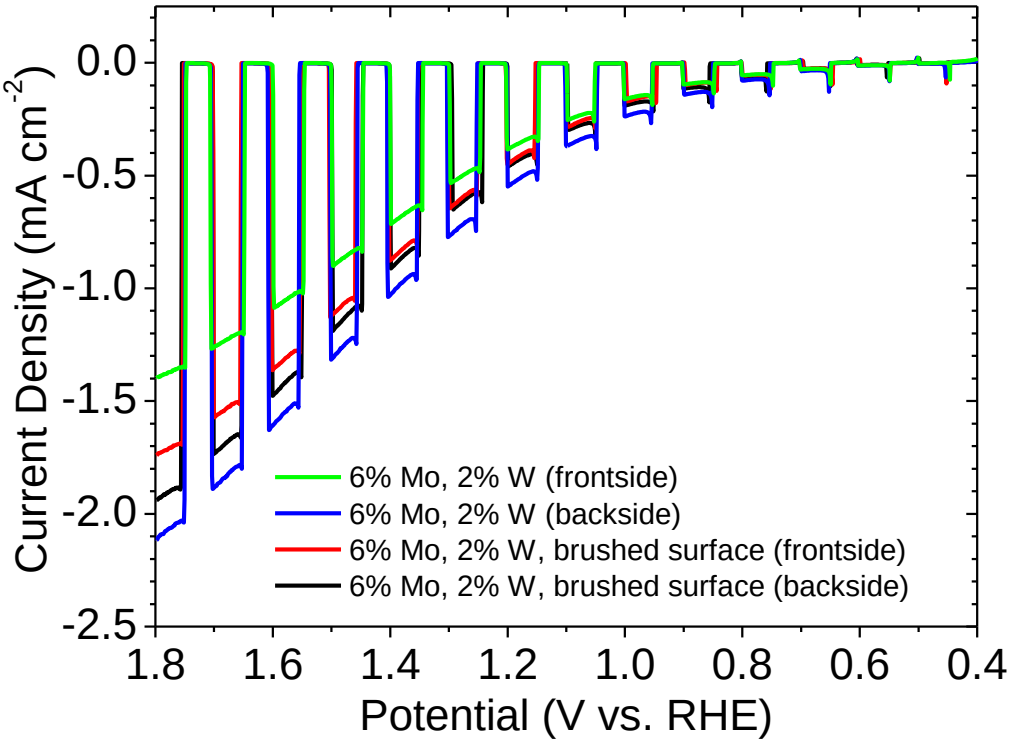

Figure S8. Chopped (dark and white light) LSV scans for a 6% Mo, 2% W $BiVO_4$ film before brushing the film surface (frontside and backside illumination) and after brushing the film surface and rinsing it with de-mineralized water to remove irregular surface structures (frontside and backside illumination). Measurements were conducted in mixture of 0.1 M Na_2SO_4 and 0.1 M phosphate buffer solution (pH 6.8) with a scan rate of 0.025 V s^{-1}.

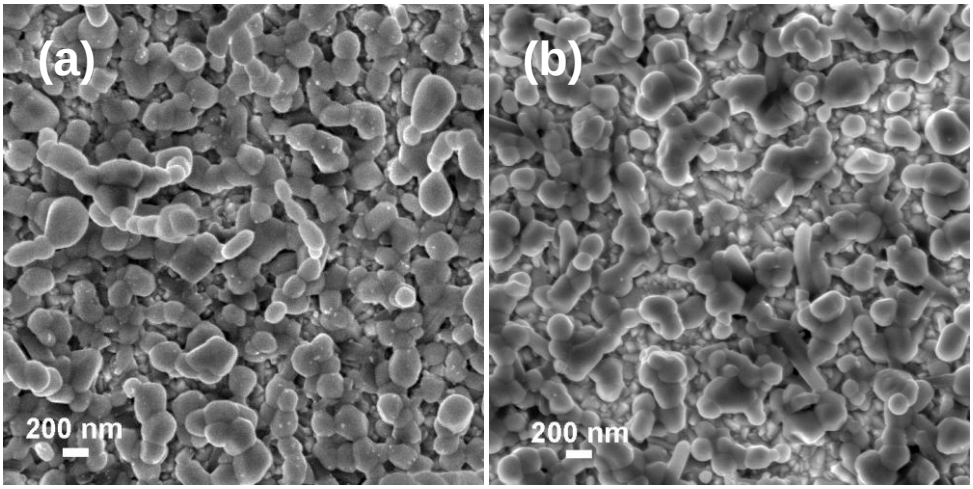

Figure S9. Top view SEM images of a 6% Mo, 2% W $BiVO_4$ film (a) before brushing the film surface and (b) after brushing the film surface and rinsing it with de-mineralized water.

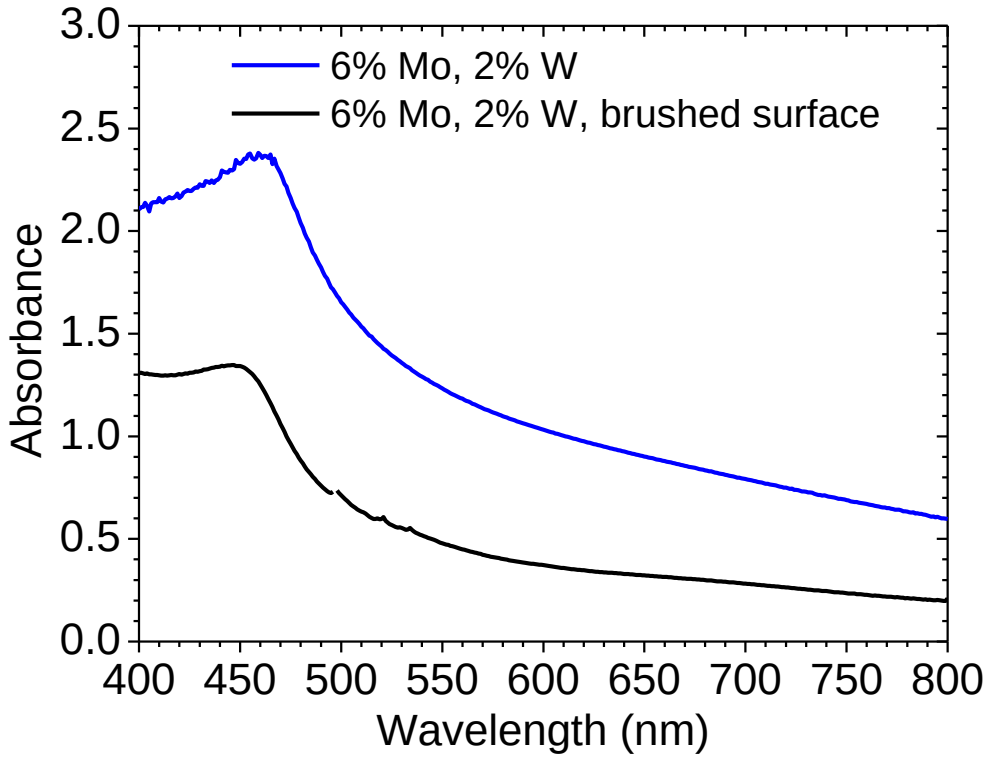

Figure S10. UV-Vis absorbance spectrum for a 6% Mo, 2% W $BiVO_4$ film taken before and after brushing the film surface and rinsing it with de-mineralized water. The measurements were taken using a Cary 5000 spectrophotometer in transmission mode so any diffusely scattered light contributed to the measured absorbance.