Cu_2O for water splitting

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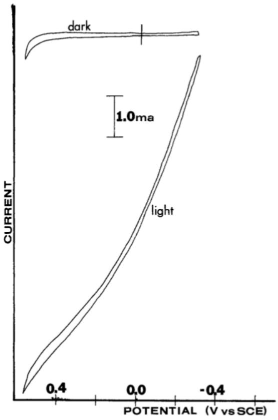
Harde et al. (Cyclic voltammetry)



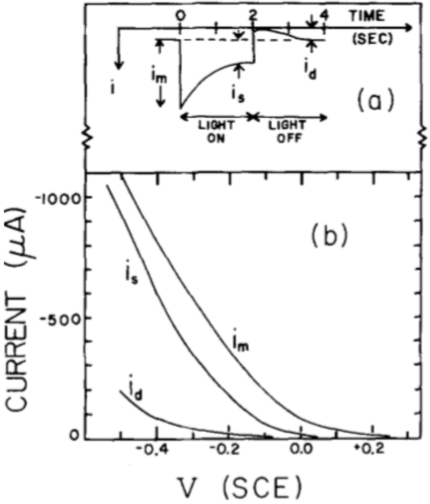
Cell

- WE: CuO
- CE: Platinum
- RE: SCE
- Soln: 1M Na $_2$ OH

Equipment

- 450-W Xe lamp from Oriel Corporation
- PAR 173 potentiostat - PAR 175 programmer
- Houston Instrument Model 2000 Omnigraphic X-Y recorder
- EG&G Model 550 Radiometer for absolute light intensity

Koffyberg et al.



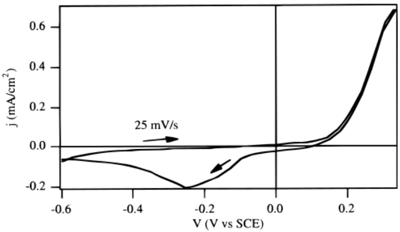
Cell

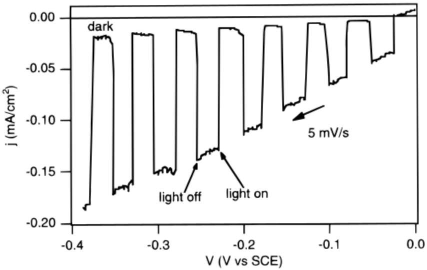
- WE: CuO
- CE: Platinized Pt
- RE: SCE
- Soln: 0.1M Na_2HPO_4

Equipment

- 150-W Xe arc (period variable from 10^1 to 10^{-3} s)
- Measurements made potentiostatically

Jongh et al.





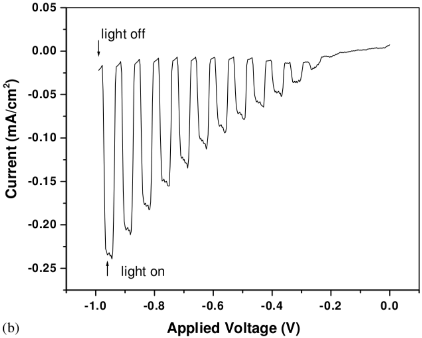
Cell

- WE: CuO
- CE: Large area Pt.
- RE: SCE
- Soln: 0.5M Na_2SO_4 or MV^{2+} (methilviologen)

Equipment

- EG&G PAR Model 273 A potentiostat
- 450-Xenon lamp

Siripala et al.



(b)

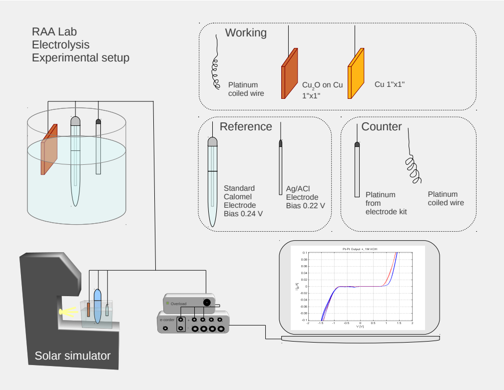
Cell

- WE: Cu_2O/TiO_2
- CE: Platinum wire
- RE: Ag/AgCl
- Soln: 0.05M sodium acetate

Equipment

- EG&G PAR Model 273 A potentiostat
- Xenon lamp (700 W/m^2)
- Monochromator (Oriel-Model 7240)
- Lock-in amplifier SR 520
- International Light IL 7200 radiometer to measure incient light intensity

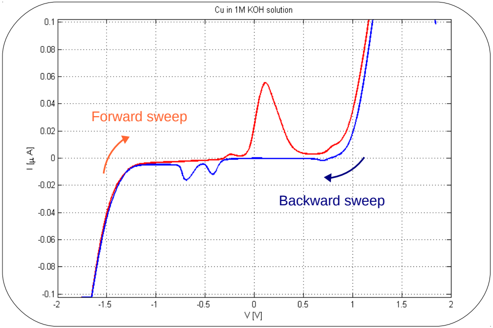
Equipment



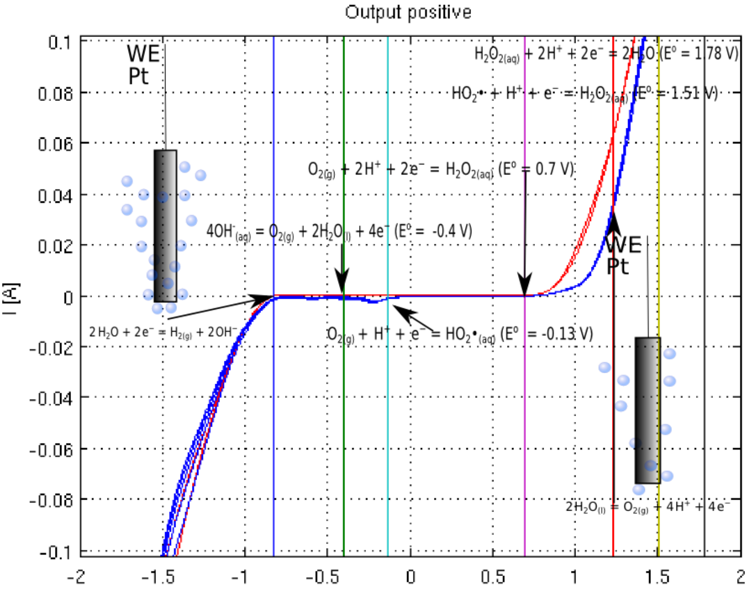
- 150 W Newport Model 91159 full spectrum Solar simulator.
- eDAQ EA160 Potentiostat with e-corder ED410.
- 1M KOH solution.
- 1 by 1 inch Cu and Cu_2O electrodes.
- Two 0.1mm-diameter coiled Pt wire electrodes.
- SCE and Ag/AgCl reference electrodes.
- 1mm-diameter Platinum electrode.

Current voltage plots with direct output (+)

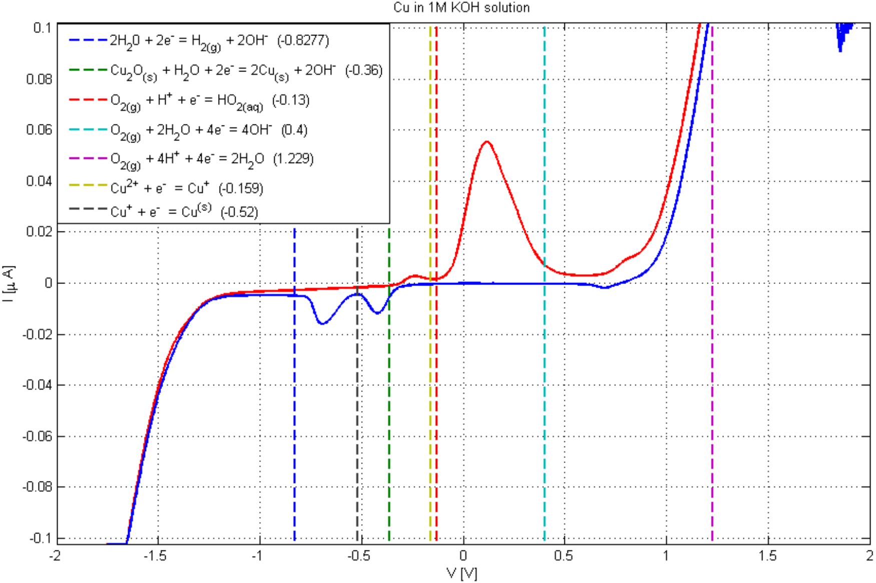
Using the positive pole of the output causes the potential applied to the WE to be more oxidising when the voltage is more positive. Hence the scan in the forward direction causes the WE to start out as the Cathode and end as the Anode.



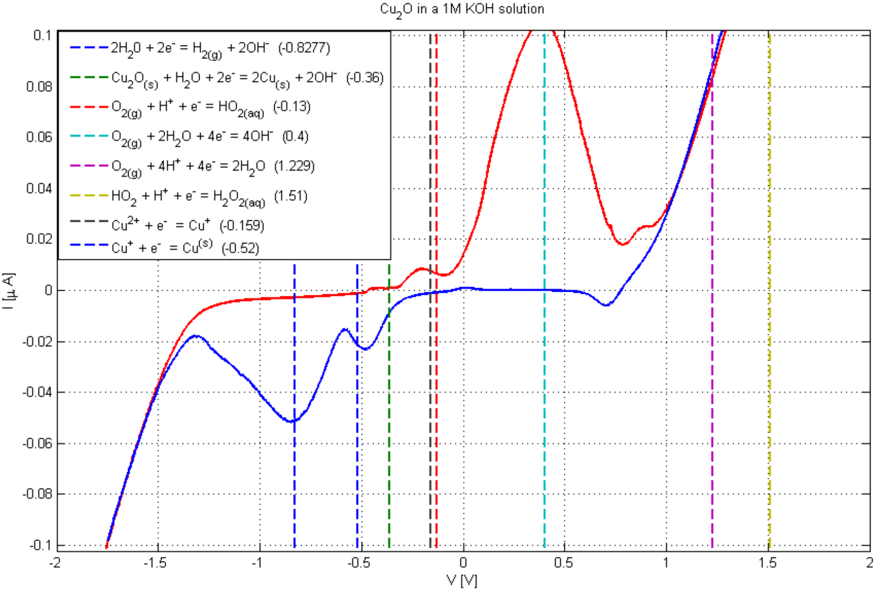
Platinum wire electrode



Cu electrode



Cu2O electrode



Time scale comparison: steady state vs ion mobility

To have a sense of the dominant dynamics in the system we roughly estimated the time scale for equilibrium ($\tau_D \approx L^2/D$) and the time scale ($\tau_\mu = L/(\mu(\delta V/\delta x))$) at which the ions travel between electrodes. We set a fixed linear distance between the WE and CE of $L = dx =$1cm in our cell, and obtain diffusion coefficients, D's, and ion mobility, μ's, data from literature. The maximum potential difference considered was 2V as in the experiments.

Species	D [m^2/s]	μ [$m^2/V/s$]	τ_D [s]	τ_μ [s]
H^+	···	3.63×10^{-7}	···	1.38
OH^-	5.27×10^{-9}	2.05×10^{-7}	1.89×10^{4}	2.44
K^+	1.95×10^{-9}	7.05×10^{-9}	5.13×10^{4}	70.92
O_2	2.10×10^{-9}	···	4.76×10^{4}	···
H_2	4.50×10^{-9}	···	2.22×10^{4}	···