Comparison of the performance of cop-coated and pt-coated radial junction n+p-silicon microwire-array photocathodes for the sunlight-driven reduction of water to H2(g)

The electrocatalytic performance for hydrogen evolution has been evaluated for radial-junction n+p-Si microwire (MW) arrays with Pt or cobalt phosphide, CoP, nanoparticulate catalysts in contact with 0.50 M H2SO4(aq). The CoP-coated (2.0 mg cm\(^{-2}\)) n\(^+\)p-Si MW photocathodes were stable for over 12 h of continuous operation and produced an open-circuit photovoltage (\(V_{\text{OC}}\)) of 0.48 V, a light-limited photocurrent density (\(J_{\text{ph}}\)) of 17 mA cm\(^{-2}\), a fill factor (ff) of 0.24, and an ideal regenerative cell efficiency (\(\eta_{\text{IRC}}\)) of 1.9% under simulated 1 Sun illumination. Pt-coated (0.5 mg cm\(^{-2}\)) n\(^+\)p-Si MW-array photocathodes produced \(V_{\text{OC}} = 0.44\) V, \(J_{\text{ph}} = 14\) mA cm\(^{-2}\), ff = 0.46, and \(\eta = 2.9\)% under identical conditions. Thus, the MW geometry allows the fabrication of photocathodes entirely comprised of earth-abundant materials that exhibit performance comparable to that of devices that contain Pt.

General information
State: Published
Organisations: Department of Physics, Experimental Surface and Nanomaterials Physics, Center for Individual Nanoparticle Functionality, Department of Micro- and Nanotechnology, Silicon Microtechnology, Pennsylvania State University, California Institute of Technology
Number of pages: 5
Pages: 1679-1683
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: The Journal of Physical Chemistry Letters
Volume: 6
Issue number: 9
ISSN (Print): 1948-7185
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 8.37 SJR 4.667 SNIP 1.595
Web of Science (2017): Impact factor 8.709
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 8.18 SJR 4.602 SNIP 1.651
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 8.04 SJR 4.143 SNIP 1.758
Web of Science (2015): Impact factor 8.539
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 7 SJR 3.725 SNIP 1.71
Web of Science (2014): Impact factor 7.458
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 6.61 SJR 3.529 SNIP 1.608
Web of Science (2013): Impact factor 6.687
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 6.3 SJR 3.965 SNIP 1.742
Web of Science (2012): Impact factor 6.585