Selective Electrochemical Generation of Hydrogen Peroxide from Water Oxidation

Selective Electrochemical Generation of Hydrogen Peroxide from Water Oxidation

Water is a life-giving source, fundamental to human existence, yet over a billion people lack access to clean drinking water. The present techniques for water treatment such as piped, treated water rely on time and resource intensive centralized solutions. In this work, we propose a decentralized device concept that can utilize sunlight to split water into hydrogen and hydrogen peroxide. The hydrogen peroxide can oxidize organics while the hydrogen bubbles out. In enabling this device, we require an electrocatalyst that can oxidize water while suppressing the thermodynamically favored oxygen evolution and form hydrogen peroxide. Using density functional theory calculations, we show that the free energy of adsorbed OH* can be used to determine selectivity trends between the 2e− water oxidation to H2O2 and the 4e− oxidation to O2. We show that materials which bind oxygen intermediates sufficiently weakly, such as SnO2, can activate hydrogen peroxide evolution. We present a rational design principle for the selectivity in electrochemical water oxidation and identify new material candidates that could perform H2O2 evolution selectively.

General information
State: Published
Organisations: Department of Energy Conversion and Storage, Atomic Scale Materials Modelling, Carnegie Mellon University, Stanford University
Contributors: Viswanathan, V., Hansen, H. A., Nørskov, J. K.
Number of pages: 5
Pages: 4224–4228
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: The Journal of Physical Chemistry Letters
Volume: 6
Issue number: 21
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
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 5.95 SJR 3.283 SNIP 1.613
Web of Science (2011): Impact factor 6.213
ISI indexed (2011): ISI indexed no
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Web of Science (2010): Impact factor
Web of Science (2010): Indexed yes
Web of Science (2009): Indexed yes
Web of Science (2008): Indexed yes
Web of Science (2007): Indexed yes
Web of Science (2006): Indexed yes
Web of Science (2005): Indexed yes
Web of Science (2004): Indexed yes
Web of Science (2003): Indexed yes
Web of Science (2002): Indexed yes
Web of Science (2001): Indexed yes
Web of Science (2000): Indexed yes
Original language: English
DOIs: 10.1021/acs.jpcl.5b02178
Source: FindIt
Source-ID: 2286809530
Research output: Research - peer-review › Journal article – Annual report year: 2015