



Second Life for Quicksilver?

Mercury is an amazing element in many ways. Not only is it the only metal that is a liquid at room temperature, mercury use was thought to prolong life, heal fractures, and to generally maintain good health in ancient Chinese and Tibetan folklore. Mercury was found in Egyptian tombs that date back to 1500 BC, and during the height of the Roman Empire in the first century AD, Pliny the Elder published a 37-volume encyclopedia on the interaction of this element with other forms of matter. On the other hand, mercury's health dangers were well-known even before tests to detect its presence in the bloodstream were developed. In fact the common English expression "mad as a hatter" describes the psychotic symptoms presented by European hat makers of the 18th century who were poisoned by mercury that was used for processing fur pelts. (Incidentally Lewis Carroll's Mad Hatter in *Alice's Adventures in Wonderland* is a play on words of this expression although this character did not exhibit any signs of mercury poisoning.)

Of course this element is no stranger to electrochemistry laboratories that have routinely used it as a cathode material for a wide variety of electroanalytical and industrial electrochemistry applications. The Nobel Prize in Chemistry was awarded in 1959 to Jaroslav Heyrovsky in recognition of his discovery of the electroanalytical technique, polarography, that was originally based on the dropping mercury electrode (DME). The high overpotential associated with mercury as an electrode surface translates to a wide accessible window for the study of many useful electrode processes in the cathodic polarization regime. However, because of environmental concerns, the DME configuration has been gradually replaced by other alternatives containing much less mercury (e.g., mercury thin film electrode). Thus the DME setup in my own research laboratory has not seen use in many years nor have my students had to deal with mercury spillage on the laboratory floor. The use of mercury cathodes in chlor-alkali cells has also been largely supplanted by solid (e.g., metal oxide or carbon-based) electrode counterparts that are much more environmentally benign.

It turns out that mercury is an exceedingly rare element in the Earth's crust (ca. 0.08 ppm average abundance). However it can be extraordinarily concentrated with the richest mercury ores containing up to 2.5% by mass. Mining of the most common mineral, cinnabar, and its subsequent refining pose severe health hazards and for this reason, this element has garnered recent media attention. The European Union has banned mercury exports and the U.S. is poised to do the same very soon. With the price of gold reaching a record high last year and the fact that mercury is the best element to refine the gold (by forming an amalgam), selling mercury has become an increasingly lucrative business these days. Like the entrepreneurs who made fortunes selling pickaxes during the California Gold Rush, mercury traders today are cashing in on gold fever. However mercury is not sold on a public exchange (unlike gold) and there is no spot price for it. Perversely international efforts to outlaw trade (because of health concerns) are making it more profitable to engage in illicit transport of mercury.

Interestingly enough, while electrochemists have curtailed their use of this element as an electrode material, mercury is still the material of choice for many technological applications. You will likely not find a mercury thermometer in your neighborhood pharmacy nor will the new thermostat in your home be mercury contact-based, both having been replaced by solid-state devices. However mercury is still used for dental restoration in many countries, and is the material of choice for fluorescent lighting. In fact the new-generation compact fluorescent lamps (CFLs) that are gradually phasing out incandescent bulbs are based on mercury. This has ignited new demand for this element and has prompted many countries (e.g., Columbia, China) to re-open cinnabar mines. We have certainly not seen the last of this rather amazing element. Stay tuned.

Raj K.

Krishnan Rajeshwar
Editor



Published by:
The Electrochemical Society (ECS)
65 South Main Street
Pennington, NJ 08534-2839, USA
Tel 609.737.1902
Fax 609.737.2743
www.electrochem.org

Editor: Krishnan Rajeshwar, rajeshwar@uta.edu

Guest Editors: Dan Doughty, dhdoughty@gmail.com
and Christopher J. Orendorff, corendo@sandia.gov

Contributing Editors: Donald Pile, donald.pile@gmail.com;
Zoltan Nagy, nagy@email.unc.edu

Managing Editor: Mary E. Yess, mary.yess@electrochem.org

Production & Advertising Manager:

Dinia Agrawala, interface@electrochem.org

Advisory Board: Arumugam Manthiram (*Battery*), Barbara Shaw (*Corrosion*), Durga Misra (*Dielectric Science and Technology*), Giovanni Zangari (*Electrodeposition*), Andrew Hoff (*Electronics and Photonics*), Mani Manivannan (*Energy Technology*), Prashant V. Kamat (*Fullerenes, Nanotubes, and Carbon Nanostructures*), Tim Armstrong (*High Temperature Materials*), John Staser (*Industrial Electrochemistry and Electrochemical Engineering*), Uwe Happek (*Luminescence and Display Materials*), Albert Fry (*Organic and Biological Electrochemistry*), Andrew C. Hillier (*Physical and Analytical Electrochemistry*), Nick Wu (*Sensor*)

Publications Subcommittee Chair: Paul Kohl

Society Officers: Fernando Garzon, *President*; Tetsuya Osaka, *Senior Vice-President*; Paul Kohl, *2nd Vice-President*; Dan Scherson, *3rd Vice-President*; Lili Deligianni, *Secretary*; Christina Bock, *Treasurer*; Roque J. Calvo, *Executive Director*

Statements and opinions given in The Electrochemical Society *Interface* are those of the contributors, and ECS assumes no responsibility for them.

Authorization to photocopy any article for internal or personal use beyond the fair use provisions of the Copyright Act of 1976 is granted by The Electrochemical Society to libraries and other users registered with the Copyright Clearance Center (CCC). Copying for other than internal or personal use without express permission of ECS is prohibited. The CCC Code for The Electrochemical Society *Interface* is 1064-8208/92.

Canada Post:

Publications Mail Agreement #40612608
Canada Returns to be sent to:
Pitney Bowes International, P.O. Box 25542,
London, ON N6C 6B2

ISSN

Print: 1064-8208
Online: 1944-8783

The Electrochemical Society *Interface* is published quarterly by The Electrochemical Society (ECS), at 65 South Main Street, Pennington, NJ 08534-2839 USA. Subscription to members as part of membership service; subscription to nonmembers is available; see the ECS website. Single copies \$9.00 to members; \$17.00 to nonmembers. © Copyright 2012 by The Electrochemical Society. Periodicals postage paid at Pennington, New Jersey, and at additional mailing offices. POSTMASTER: Send address changes to The Electrochemical Society, 65 South Main Street, Pennington, NJ 08534-2839.

The Electrochemical Society is an educational, nonprofit 501(c)(3) organization with more than 8000 scientists and engineers in over 70 countries worldwide who hold individual membership. Founded in 1902, the Society has a long tradition in advancing the theory and practice of electrochemical and solid-state science by dissemination of information through its publications and international meetings.



All recycled paper. Printed in USA.