

Zeitschrift: Energie extra
Herausgeber: Office fédéral de l'énergie; Energie 2000
Band: - (2004)
Heft: 3: [english]

Rubrik: Impressum

Nutzungsbedingungen

Die ETH-Bibliothek ist die Anbieterin der digitalisierten Zeitschriften auf E-Periodica. Sie besitzt keine Urheberrechte an den Zeitschriften und ist nicht verantwortlich für deren Inhalte. Die Rechte liegen in der Regel bei den Herausgebern beziehungsweise den externen Rechteinhabern. Das Veröffentlichen von Bildern in Print- und Online-Publikationen sowie auf Social Media-Kanälen oder Webseiten ist nur mit vorheriger Genehmigung der Rechteinhaber erlaubt. [Mehr erfahren](#)

Conditions d'utilisation

L'ETH Library est le fournisseur des revues numérisées. Elle ne détient aucun droit d'auteur sur les revues et n'est pas responsable de leur contenu. En règle générale, les droits sont détenus par les éditeurs ou les détenteurs de droits externes. La reproduction d'images dans des publications imprimées ou en ligne ainsi que sur des canaux de médias sociaux ou des sites web n'est autorisée qu'avec l'accord préalable des détenteurs des droits. [En savoir plus](#)

Terms of use

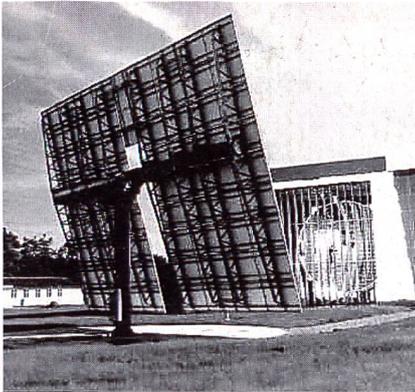
The ETH Library is the provider of the digitised journals. It does not own any copyrights to the journals and is not responsible for their content. The rights usually lie with the publishers or the external rights holders. Publishing images in print and online publications, as well as on social media channels or websites, is only permitted with the prior consent of the rights holders. [Find out more](#)

Download PDF: 31.03.2026

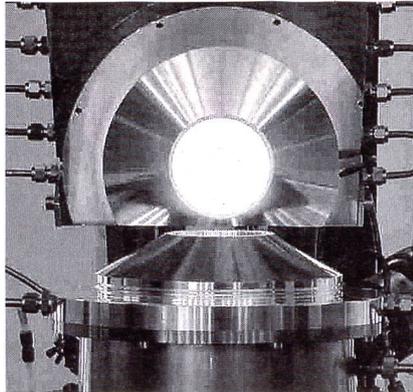
ETH-Bibliothek Zürich, E-Periodica, <https://www.e-periodica.ch>

HYDROGEN

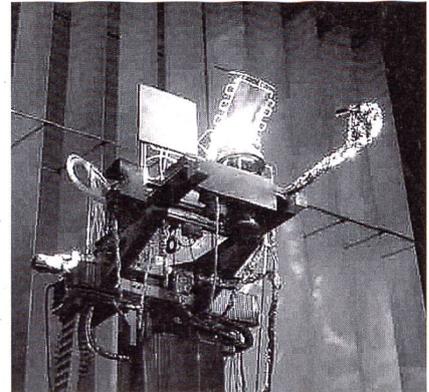
Solar sandwich



The solar "oven" at the Paul Scherrer Institute in Villigen



The opening of the solar reactor after an experiment



Experiment rig in the solar oven

Swiss research groups in the vanguard of developments in hydrogen electrolysis

Hydrogen is generally regarded as the most promising substitute for fossil fuels. But future large-scale use of hydrogen as a fuel will only be feasible if it can be produced on a sustainable basis. Swiss research is pursuing two alternative approaches to hydrogen generation using solar energy.

Tandem cell. Researchers at the Federal Institute of Technology in Lausanne (EPFL) and the University of Geneva have collaborated to develop a solar cell that produces hydrogen. "Our technology promises higher efficiency and lower cost than the conventional 'brute force' method in which solar electricity drives an electrolysis unit," declares Michael Grätzel, Head of the Laboratory for Photonics and Interfaces at the EPFL.

The new solar cell consists of a sandwich of two light-absorbing layers, hence the name

"tandem cell". The upper part absorbs the blue component of sunlight, whose energy is used to oxidize water. In the first half of the reaction, oxygen ions are split off from the water.

In the other half, the remaining hydrogen ions are reduced to form hydrogen gas. The electricity needed is generated in the lower part of the sandwich. This consists in turn of a dye cell to absorb the red and green components of the sunlight.

Jan Augustynski and his team at the Institute of Chemistry at Geneva University have developed the vital component needed for the cell: a thin translucent film consisting of billions of minute particles (so-called nanocrystals) of the semiconductor material tungsten-oxide. The tungsten film forms the photo electrode absorbing the blue sunlight in the upper part.

The new tungsten film enables the production of tandem cells that store 5 to 6 percent of the incident sunlight in the form of hydrogen. This is a major advance compared to earlier technologies. The process is patented, and is to be developed in collaboration with an English company.

Moreover, to increase efficiency, new materials are being tried to accelerate the chemical processes taking place in the electrodes. Water, for example, can be electrolysed three-times more efficiently using a silver-chloride electrode in which gold particles of several nanometers diameter are dispersed – the crux of research by Antonio Currao and Gion Calzaferri at the Department of Chemistry and Biochemistry at Berne University.

Solar inferno. The Paul Scherrer Institute in Villigen (PSI) is pinning its hopes on the reaction between zinc and water vapour. The final

products being simply hydrogen and zinc oxide. The zinc oxide can be converted back to metallic zinc in a solar crucible, and the cycle begun anew. As in the tandem cell, solar energy is again stored in the form of hydrogen, but in quite a different way.

To reduce the zinc oxide, mirrors direct sunlight onto the crucible to generate the temperature of 2000°C required. The "solar inferno" in the crucible makes heavy demands on the employed materials technology. Says Robert Palumbo, Head of the Laboratory for Solar Technology: "When carbon is injected into the zinc oxide, pure zinc is obtained at a much lower temperature of 1200°C. We are studying this variant at PSI within an international project." Though the process is no longer CO₂-free, the prospects of market maturity are much better in the middle term.

Eco Marathon hydrogen car

Last year, a hydrogen PAC (French abbreviation for "pile à combustible", or fuel cell) car took part for the first time in the Shell Eco Marathon at Nogaro in Southern France. The Federal Institute of Technology in Zurich developed the car in collaboration with the Paul Scherrer Institute and the University of Valencienne.

The car uses a fuel cell to convert hydrogen into electricity to power its electric motor. Although this ultra-light, single-seater vehicle carries only 15 grams of hydrogen in its metal hydride tank, it is enough to travel 90 km (equivalent to 1500 km on 1 litre of petrol). Eco Marathon's benchmark is to cover 25 km at an average speed equalling or exceeding 30 km/h with rock-bottom fuel consumption.

Impressum

energy extra
published every 2 months
edition 3/2004



Publisher

Swiss Federal Office of Energy (BFE), 3003 Berne, Switzerland

Editorial staff

Marianne Zünd, Mireille Fleury, Communication Section,
Telephone +41 31 322 5611, Fax +41 31 323 2510
www.energie-schweiz.ch
Email: office@bfe.admin.ch
Büro Cortesi, Biel, Switzerland, Tel +41 32 327 0911,
Fax +41 32 327 0912
Email: buerocortesi@bcbiel.ch
Werner Hadorn (editor)
Texts: Hans-Ueli Aebi, Jean-Jacques Daetwyler,
Fabio Gilardi, Werner Hadorn, BFE
Translation: Brian Backman, Bob Barton, James Morris
Photographs + illustrations: Fabio Gilardi, Olivier Messerli
Layout: Hans Eggmann