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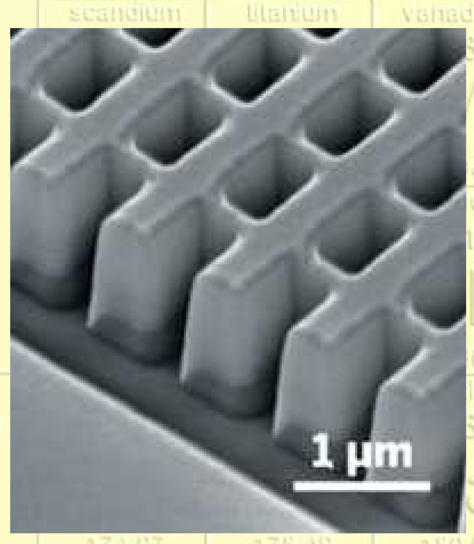
Editors: Gabriel Aullón, Ramón Bosque i Joaquim Sales. Correspondència: noticies@qi.ub.es

La invisibilitat més a prop

Two breakthrough developments in the fabrication of metamaterials are reported in a pair of research papers by Xiang Zhang and coworkers at the University of California, Berkeley. Metamaterials are composites designed to have a negative index of refraction, which imparts the extraordinary capability to bend light away from or around an object made from or coated with the material. These composites could lead to lenses that permit optical imaging at the molecular level, nanocircuits for more powerful computers, and, to the thrill of science-fiction lovers, cloaking devices that render objects invisible to the human eye.

In one study, Zhang and coworkers alternated thin layers of silver and magnesium fluoride on a substrate, then cut nanoscale “fishnet” patterns into the layers (*Nature*, **2008**, *455*, 376). The composite, which has a negative refractive index in near-infrared light, is the first three-dimensional metamaterial in the optical region; in the past, metamaterials have been limited to thin layers or longer wavelength microwaves. In a second study, the team built a metamaterial from silver nanowires electrochemically deposited in porous aluminum oxide (*Science* **2008**, *321*, 930). This composite exhibits negative refraction down to 660 nm, the first example of a bulk metamaterial in the visible region.

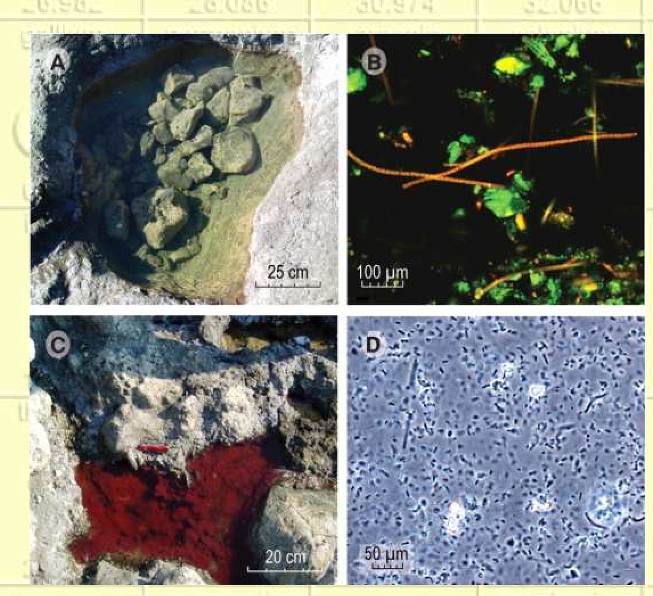


Fotosíntesi amb arsènic

Researchers have found two microbial species that use arsenite (AsO_3^{3-}) to supply electrons for photosynthesis instead of water typically used by most plants (*Science* **2008**, *321*, 967).

During photosynthesis, plants use sunlight to extract electrons from water and donate them to carbon dioxide. They then use the carbon and hydrogen to build biomass and release oxygen as a by-product. But a team led by Ronald S. Oremland of the U.S. Geological Survey discovered red- and green-colored microbes growing in anoxic, hot-spring-fed brine pools at Mono Lake, in California, which extract electrons from arsenite instead of water.

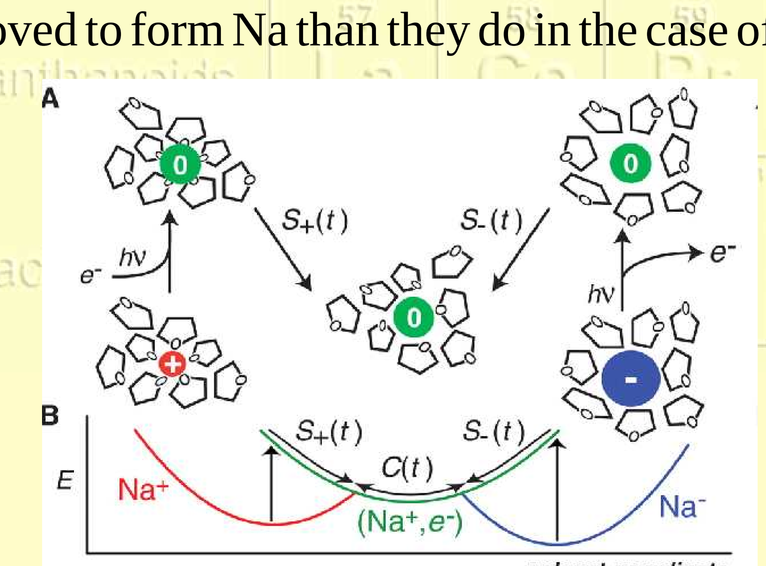
The researchers identified the microbes' quirky metabolism while growing the organisms in the lab. Only after exposing each microbe to light did they find that arsenite was being oxidized to arsenate (AsO_4^{3-}). These species of microbes and other extremophiles are thought to have evolved almost 3 billion years ago as a consequence of their seemingly inhospitable, low-oxygen environment. The newly discovered chemistry provides a further glimpse of what life might have been like on early Earth, the researchers propose.



El solvent no és innocent

Scientists generally treat solvents as an undifferentiated sea of molecules. But UCLA chemistry professor Benjamin J. Schwartz and coworkers now find experimental evidence for individualistic behavior of solvent molecules during some reactions (*Science* **2008**, *321*, 1817). The finding manifests itself as a "breakdown" of linear response theory, used to predict the behavior of numerous physical and chemical systems. It holds that the rates at which solvents relax into equilibrium should be the same when the end results are the same, regardless of how the system began.

The UCLA group studied the phenomenon for electron-transfer reactions of sodium atoms in a bath of tetrahydrofuran molecules. In one reaction, they removed an electron from Na^-, and in the other, they added an electron to Na^+.Both reactions generated neutral Na, with the surrounding tetrahydrofuran molecules eventually relaxing into equilibrium within picoseconds. But dynamics of the absorption spectra of the two processes were very different, showing that the solvent surrounding the Na^- starting material took about twice as long, 7.5 picoseconds, to relax. The group suggests that because Na^- is a much larger species than Na or Na^+, solvent molecules need more time to fill in the void left when an electron is removed to form Na than they do in the case of the Na^+ reaction.

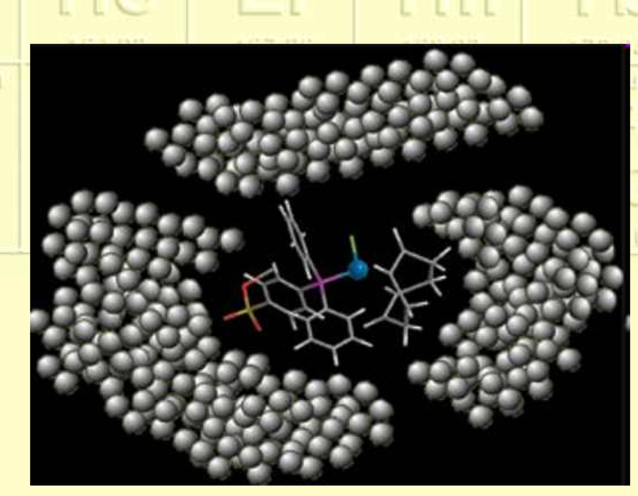


2 x 1, també en catalitzadors

By entrapping a soluble rhodium complex inside a matrix of silver atoms, a team of Israeli chemists has initiated a new approach to heterogeneous catalysis (*J. Am. Chem. Soc.*, **2008**, *130*, 11880). Chemists often harness soluble homogeneous catalysts for surface-based heterogeneous reactions by fixing the catalyst on an organic polymer or an inorganic oxide such as silica, which are insulating materials. The catalyst-in-metal composite developed by David Avnir and coworkers at Hebrew University of Jerusalem marks the first time a homogeneous catalyst has been "heterogenized" in a conducting material.

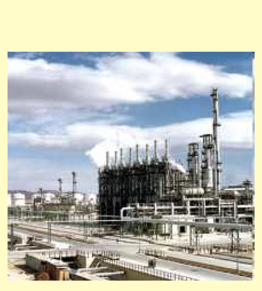
To make the material, the researchers added zinc powder to a solution containing a rhodium phosphine cyclooctadiene catalyst and silver nitrate. The zinc reduces the silver cations, and as silver crystallites form they aggregate and precipitate out of the solution, taking the catalyst with it. The rhodium complex ends up entrapped within the three-dimensional metal matrix, as opposed to being adsorbed on the metal surface.

The researchers tested the catalyst by hydrogenating styrene to ethylbenzene and diphenylacetylene to stilbene. The composite catalyst outperformed the rhodium catalyst alone and the rhodium catalyst adsorbed on silver; pure silver, used as a control, showed no reactivity.



Breus

•Els forenses d’Estats Units critiquen els mètodes *científics* emprats en la sèrie de televisió CSI, com ara l’anàlisi d’ADN mitjançant cromatografia de gasos
(http://acscareers.wordpress.com/2008/08/25/a-far-cry-from-csi/)



• Es compleix un segle de la patent de la preparació de l’amoníac pel mètode de Haber-Bosch, un procés que va canviar el món: es creu que gairebé la meitat de la població mundial depèn d’adobs fabricats a partir de l’amoníac per a la seva alimentació (J. W. Erisman *et al*., *Nature Geoscience* **2008**, *1*, 636)

Avui recomanem

The University of Nottingham

La Universitat de Nottingham ha preparat una sèrie de videos sobre els 118 elements químics, que ha penjat a Youtube. *No us ho perdeu!*

http://www.periodicvideos.com

L’element

L'element número **42**, **molibdè**, fou descobert l'any 1778 per Carl Welhelm Scheele, en el mineral molibdenita (MoS_2), el nom del qual prové del grec “*molybdos*” (μολβδοσ) que vol dir “com el plom”, per la creença que contenia aquest element. Fou aïllat el 1781 per Peter Jacob Hjelm, per reducció amb carbó.

S'usa en la fabricació d'acers resistents i lleugers apropiats per a la construcció d'avions i automòbils. El MoS_2 és un bon lubricant a temperatures elevades en què molts olis descomponen. A partir del ^{99}Mo s'obté l'isòtop metastable ^{99m}Tc, molt emprat en medicina com a agent de contrast en el diagnòstic per imatge del cor, cervell i ronyons.