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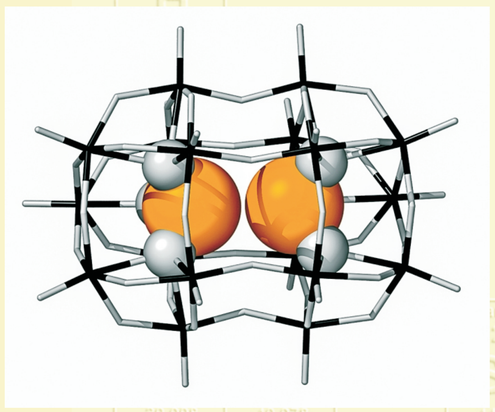
Memòries i clústers

Seeking to keep up with technology's relentless drive for smaller and smaller electronic components, chemists have developed molecules that could be the next big little thing in flash memory storage. In flash memory, components can be erased and reprogrammed using electricity. Flash memory components currently in computers and smartphones use metal oxide semiconductor materials. But scaling down these materials further while increasing storage capacity has been challenging. Researchers have suggested using single molecules as flash memory components. However, the molecules that have been proposed so far suffer from low electrical conductivity, high resistance, and finite thermal stability.

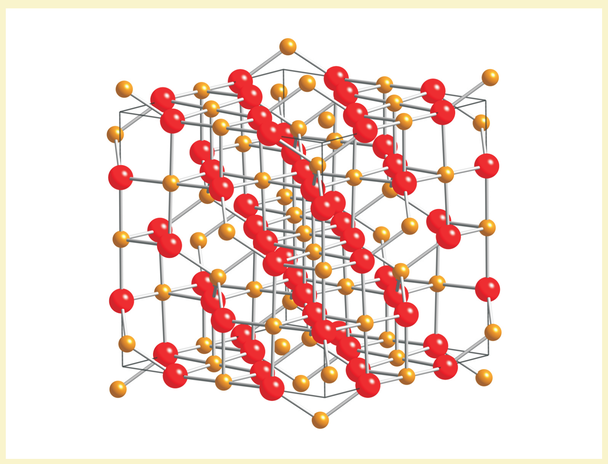
Scientist believe polyoxometalate clusters, such as $[W_{18}O_{54}(SeO_3)_2]^{4-}$, can circumvent these problems (L. Cronin et al., *Nature,* **2014**, *515*, 545; DOI: 10.1038/nature13951). Not only do the clusters act as perfect examples of trapped charge essential for flash memory programming, but electronically active dopants within the clusters can be shifted between two oxidation states, Se(IV) to Se(V), giving a new type of memory behavior.



This $[W_{18}O_{54}(SeO_3)_2]^{4-}$ polyoxometalate cluster ($W_{18}O_{54}$ cage is black and gray, and Se is orange) could become the foundation for new flash memory storage.

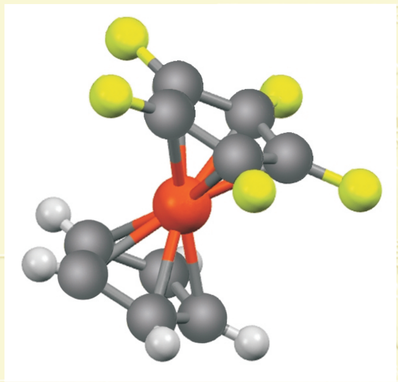
La magnetita reinterpretada

Magnetite (Fe_3O_4) is an inexpensive abundant material with surface properties that make it useful in heterogeneous catalysis, biotechnology, and other areas. The oxide has an unexplained knack, for example, for pinning individual, catalytically active precious-metal atoms on its surface and holding them in place even at high temperature. Researchers trying to understand the basis of that property, which could lead to exceptionally well dispersed catalysts, nearly always focus on the way oxygen vacancies in Fe_3O_4's surface shape its electronic properties. But according to a team (G.S. Parkinson et al., *Science,* **2014**, *346*, 1215; DOI: 10.1126/science.1260556) oxygen vacancies aren't the key players. Rather, Fe_3O_4's properties are governed by missing iron atoms in the subsurface layer . On the basis of experimental and computational analyses, the team concludes that in response to chemical reaction conditions, iron oxide shuffles iron ions. Precious-metal atoms latch onto the surface directly above the lattice positions where the metal ions are missing. Because these vacancies are spaced at regular intervals, the precious-metal atoms also remain well spaced and do not diffuse and form clusters.



A la fi el ferrocè ben fluorat

Ferrocene, the iconic sandwich-shaped metal complex, is the compound that made researchers hungry to explore organometallic chemistry. Chemists have prepared countless derivatives by modifying ferrocene's two cyclopentadiene rings. But fluorinated ferrocenes have proven elusive, a frustrating situation given the importance of fluorinated hydrocarbons in catalysis. Chemists in Germany have now made 1,2,3,4,5-pentafluoroferrocene, which is only the second fluorinated ferrocene reported, after monofluoroferrocene in 1971 (J. Am. Chem. Soc., **2014**, *137*, 126; DOI: 10.1021/ja511588p). The authors performed five sequential lithiation-fluorination reactions to obtain pentafluoroferrocene in 6.7% yield from ferrocene. Chemists in the 1960s predicted that polyfluorinated ferrocenes would have high oxidative stability. Surprisingly, cyclic voltammetry data suggest the new compound is easy to oxdize, particularly when compared with pentachloroferrocene or with similar ruthenium complexes. The researchers corroborated their experimental results with density functional theory calculations and verified pentafluoroferrocene's structure with NMR and IR spectroscopy and X-ray crystallography.



X-ray crystal structure of pentafluoroferrocene.

Informació astroquímica

Water contained in the comet 67P/Churyumov-Gerasimenko has a deuterium/hydrogen ratio vastly unlike that on Earth, (M. Hässig et al., *Science,* **2014**, *347*, aaa0276; DOI: 10.1126/science.1261952). The finding implies that comets may not have seeded our nascent planet with water. A more likely water source for Earth would be asteroids, experts now say. These planetary bodies would have still been laden with water billions of years ago, before being gradually dried by the sun.

NASA's Mars rover Curiosity has discovered that organic compounds are present in the soil of the Red Planet. Curiosity also recently detected a localized but dramatic surge of methane of unknown origin in the martian atmosphere (Ch.R.Webster et al., *Science,* **2014** *347*, 415;, DOI: 10.1126/science.1261713). Organic compounds, particularly methane, are generally produced by living organisms, although these compounds can be synthesized by abiotic reactions of soil, water, and solar radiation. Right now, scientists say they have no way of determining their source on Mars. But the rover did detect the presence of chlorobenzene, dichloroethane, dichloropropane, and dichlorobutane. The molecules are likely the products of precursor organics and formed during heating of the perchlorate-rich martian soil.

Comet 67P/Churyumov-Gerasimenko, shown in this image from the Rosetta spacecraft, has water unlike that on Earth.

Breus

• La detecció d'enllaços d'hidrogen pel microscopi de forces atòmiques (AFM) publicada l'any passat i que fou recollida en el número 65 del mes de novembre de *Notícies Inorgàniques*, ha estat qüestionada, ja que s'han detectat senyals semblants entre àtoms de nitrogen que no estan enllaçats a cap hidrogen (*Chem. Eng. News*, 92(51), 17; 22.12.2014).

• Investigadors de la Universidad de Cantaria han explicat que el color blau característic del pigment anomenat «Blau egipici», $CuCaSi_4O_{10}$, és degut al camp elèctric creat per l'anió silicat sobre CuO_4^{6-} (P. García et al., *Inorg. Chem*., **2015,** *54,* 192; DOI: 10.1021/ic502420j).

• S'ha publicat un mètode de síntesi que és capaç d'obtenir l'aninflamatori *ibuprofè* en tres minuts (T.F. Jamiso et al., *Angew. Chem. Int. Ed.*, **2014,** 983; DOI: 10.1002/anie.201409093)

L'element

HOW TO PRONOUNCE

YTTERBIUM
(it'er'be'em)

L'element número 70, **iterbi**, fou descobert pel químic suís Jean Charles Galissard de Marignac l'any 1878, com un component de l'erbia que anomenà iterbia, pel nom de la ciutat sueca on el va trobar. L'any 1907, el químic francès Georges Urbain va obtenir de la iterbia dos components, que anomenà neoiterbia i lutècia, a partir dels quals s'obtingueren els elements iterbi i luteci, respectivament. Pràcticament al mateix temps, el químic austríac Carl Auer von Welsbach, va aïllar aquests dos nous elements que anomenà "*aldebarani*" i "*cassiopei*". No es preparà iterbi pur fins l'any 1953, per mètodes d'intercanvi iònic, moment en què s'estudiaren i determinaren les seves propietats físiques i químiques, que són les pròpies d'un element del grups dels lantànids.

L'iterbi té set isòtops estables i dos de radioactius que s'empren en medicina; a partir de Yb-168 s'obté Yb-169 que s'usa com a productor de raigs gamma, i, també, en el tractament del càncer de pròstata.

Altres aplicacions de l'itri és com agent dopant per a l'augment de la resistència, fatiga i altres propietats mecàniques de l'acer inoxidable.

Avui recomanem

El lloc web de la Universitat de Princeton, «Els papers d'Eisntein», ***einsteinpapers.press.princeton.edu***, que posa a l'abast del públic en general, a tots els escrits d'Albert Einstein, que passà els últims anys de la seva vida en aquesta universitat del EUA. El web permet consultar els textos en els idiomes originals i la seva traducció a l'anglès, i permet, també, l'accés a milers d'imatges d'alta qualitat.