

Notícies Inorgàniques

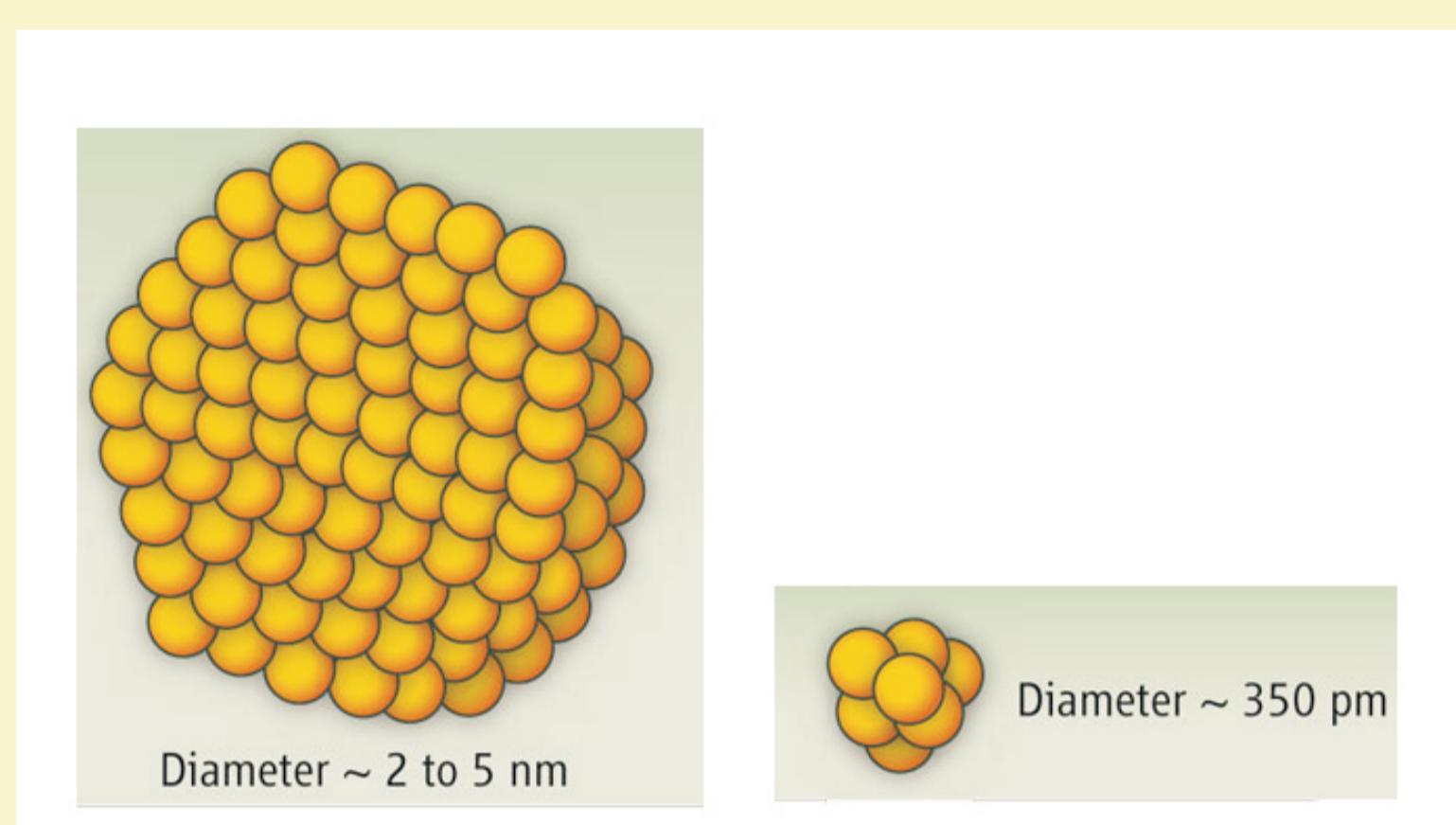
Any 12, Núm. 62, Febrer de 2013

<http://www.ub.edu/inorgani/dqi.htm>

Res millor que el pico-or

Gold may be highly desired by commodity traders and jewelry buyers, but the metal's popularity in the chemical industry has been limited by its modest abilities as a catalyst. Now, researchers of Universitat Politècnica de València (A. Corma et al. *Science*, **2012**, 338, 1452), report a gold catalyst that performs alkyne hydration with turnover or substrate conversion numbers on the order of about 10 million and turnover frequencies of some 100,000 per hour. The values approach those for catalytic metals used more commonly in industry, such as platinum and palladium. Curiously, the catalysis is performed by clusters of three to 10 gold atoms. The assemblies are larger than the catalytic species involved in homogeneous or single-phase catalysis and smaller than the nanosized clusters of dozens of atoms involved in heterogeneous or mixed-phase catalysis.

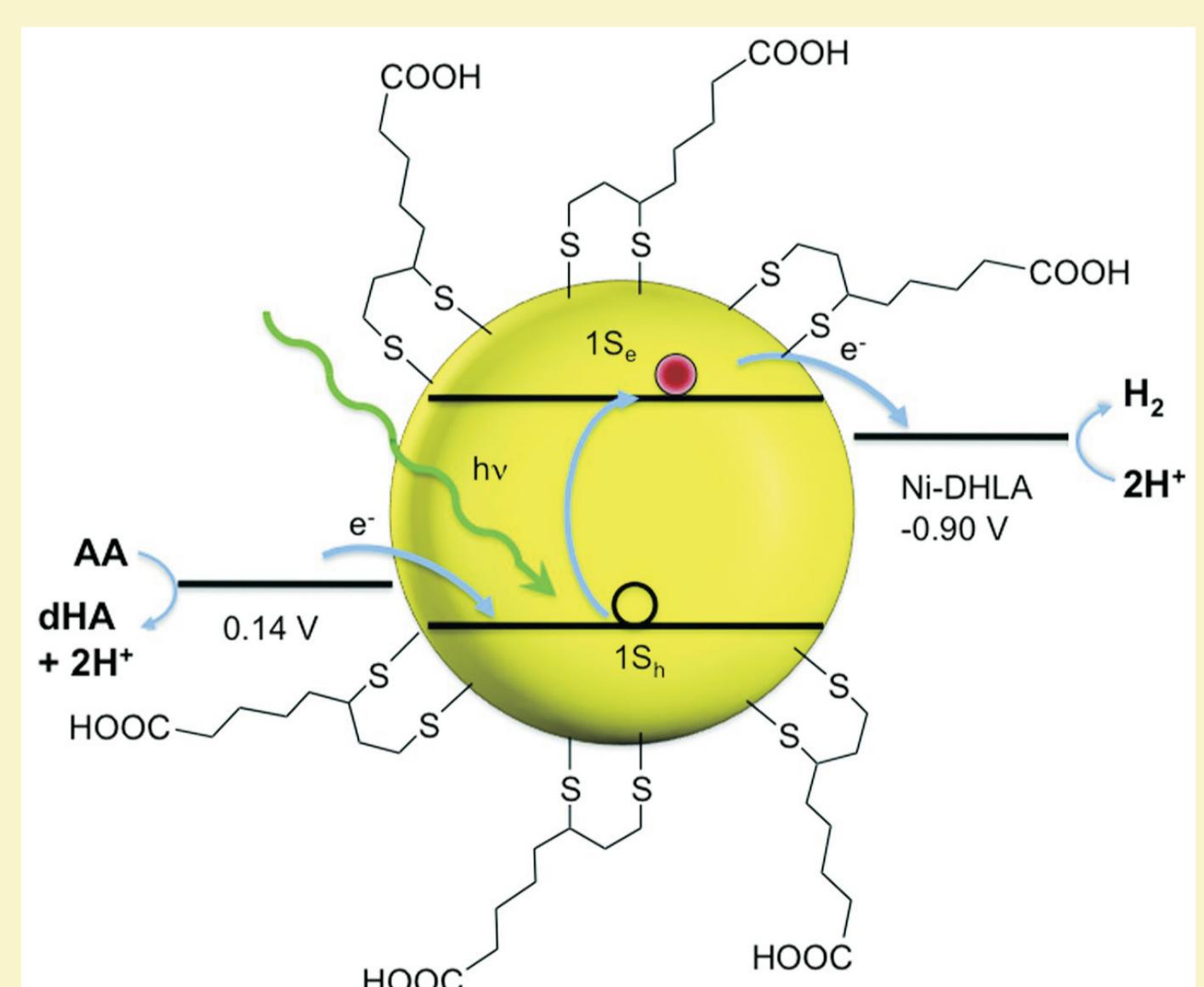
The results suggest that the catalysis community will need to rethink the classical division between homogeneous and heterogeneous catalysis. For true industrial uses, however, the catalytic gold clusters will first need to be stabilized because they are currently short-lived and the catalyst will also have to show good performance in industrial-scale reactions.



Dues setmanes fent hidrogen

A nanocrystal-based system that continuously generates hydrogen gas from light and protons for at least two weeks has been developed (Z. Han. *Science*, **2012**, 338, 1321). The catalytic scheme joins a growing list of strategies that strive to tear apart water molecules with sunlight to produce H₂, which can be used in fuel cells to produce electricity.

In addition to using simple components such as Earth-abundant elements and visible light to make fuel, the researchers say their approach has the added benefit of being the longest-lasting nanoparticle-based photocatalytic system yet. To generate H₂, the researchers irradiate an aqueous solution of nickel(II) nitrate, ascorbic acid, and dihydroxylic acid-coated CdSe nanocrystals with 520-nm light. The light triggers electron transfer from the nanocrystals to a catalyst complex formed between nickel and dihydroxylic acid. The catalyst complex then reduces protons supplied by ascorbic acid to form H₂. Aside from determining the structure of the nickel catalyst, the next step will be to improve the system's quantum yield, which is currently 36%.



This photocatalytic system generates H₂ from protons when light triggers electron transfer from a CdSe nanocrystal to a nickel catalyst complex.

Breus

- S'ha proposat un nou mètode que millora molt significativament la capacitat d'identificar les empremtes digitals. Genera el «negatiu» de l'empremta i, contràriament als mètodes convencionals, no depèn de la suor dels dits. (N. Jaber. *Angew. Chem. Int. Ed.*, **2012**, 51, 12224).
- Les empreses de roba **Mango** i **Zara** són la vuitena i novena marques del món que han subscrit la campanya «*detox*» de **Greenpeace**, en comprometre's a no emprar substàncies químiques nocives en els seus productes.
- Després de molts anys de discussió la Unió Europea ha aprovat un Sistema Unificat de Patents, que serà oficial a tots els països que ho signin. Dissortadament, Espanya i Itàlia no s'hi han adherit, perquè les noves patents europees estaran escrites en anglès, francès o alemany.

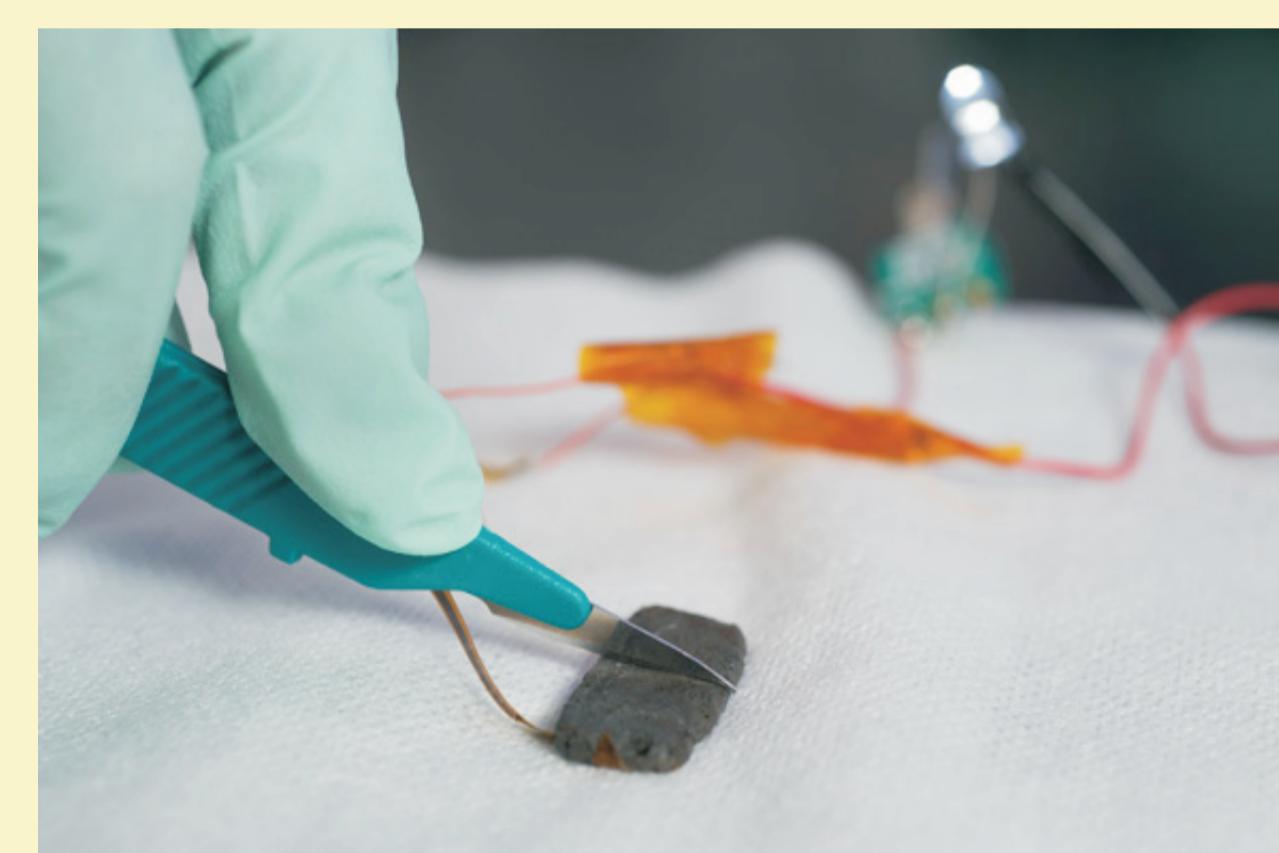
Avui recomanem

El llibre "Wonderful Life with the Elements. The Periodical Table Personified" de l'autor de còmics japonès Bunpei Yorifuji, que és una graciósia introducció a la Química. Els elements químics estan representats per ninots que reflecteixen les seves propietats físiques i químiques, per exemple els elements pesants són grisos i els artificials robots. Conté, a més, una Taula en format pòster. (ISBN: 978-1-59327-423-8. 18 \$).

Pell artificial a tocar

A team of Stanford chemists and engineers has created the first synthetic material that is both sensitive to touch and capable of healing itself quickly and repeatedly at room temperature. The researchers succeeded by combining two ingredients, the self-healing ability of a plastic polymer and the conductivity of a metal (Z. Bao et al. *Nature Nanotechnology*, **2012**, 7, 825).

They started with a plastic consisting of long chains of molecules joined by hydrogen bonds, the relatively weak attractions between the positively charged region of one atom and the negatively charged region of the next; these dynamic bonds allow the material to self-heal. The molecules easily break apart, but then when they reconnect, the bonds reorganize themselves and restore the structure of the material after it gets damaged. The result is a bendable material, which even at room temperature feels a bit like saltwater taffy left in the fridge. The next step was to see how well the material could restore both its mechanical strength and its electrical conductivity after damage. They also explored how to use the material as a sensor. For the electrons that make up an electrical current, trying to pass through this material is like trying to cross a stream by hopping from stone to stone. The stones in this analogy are the nickel particles, and the distance separating them determines how much energy an electron will need to free itself from one stone and move to another. Twisting or putting pressure on the synthetic skin changes the distance between the nickel particles and, therefore, the ease with which electrons can move.

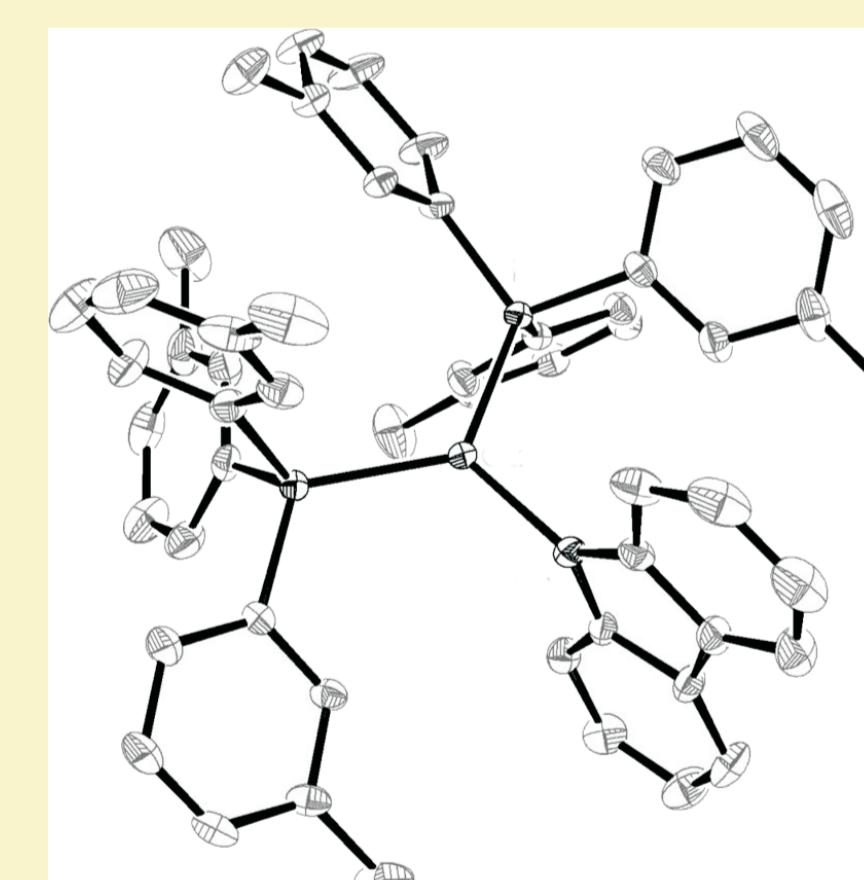


A small slice of the self-healing material; the material repairs itself in about 30 minutes.

Es fa la llum 110 anys després

Light exposure can trigger the seminal, 110-year-old Ullmann reaction—which typically forges C–N bonds via heat and a copper complex—showing that the reaction can proceed via single-electron transfer (S. E. Creutz et al. *Science*, **2012**, 338, 647). This finding will prompt the design of new ways to leverage this type of coupling reaction, which is widely used to form arylamines from aryl halides and amines for use in pharmaceuticals and materials science. The work may lead to practical variants of the C–N bond-forming process that work under mild conditions.

The authors designed C–N coupling experiments using both stoichiometric and catalytic amounts of a copper-carbazolidine complex and exposure at room temperature to a 13-W compact fluorescent lightbulb or a 100-W mercury lamp. Their results indicate that photons cause the copper complex to transfer an electron to the aryl halide, cleaving the aryl halide's carbon-halogen bond and producing a radical ion pair, which then leads to C–N bond formation between the aryl halide and carbazole.



Copper carbazolidine complex used as catalyst

L'element



L'element número 62, el **samari**, fou descobert pel químic francès Paul Émile Lecoq de Boisbaudran, en el mineral samarskita, $(Y,Ce,U,Fe)_3(Nb,Ta,Ti)_5O_{16}$. El nom del mineral prové del de l'oficial de mines rus, Vasili Samarsky, que va passar a ser, així, la primera persona a donar nom a un element químic. Aquest element havia estat detectat abans, el 1853, per Jean Charles Galissard de Marignac, en l'espectre d'absorció de l'element anomenat, aleshores, didimi. És més abundant a la terra que altres metalls més populars com l'estany. La principal aplicació és en la fabricació d'imants en aliatges amb el cobalt, SmCo₅ o Sm₂Co₁₇, que tenen una magnetització permanent 10000 vegades la del ferro, només superada pels imants de neodimi (vegeu *Notícies Inorgàniques*, 60; setembre, **2012**); s'emprén en motors petits, auriculars i “pickups” per instruments musicals. Alguns dels seus compostos són bons catalitzadors en processos de descomposició de plàstics i en la deshidratació i deshidrogenació de l'etanol.

No se li coneix cap paper biològic i té una toxicitat baixa. La quantitat de samari en el cos d'un adult és d'uns 50 micrograms, la major part del qual al fetge i ronyons. D'altra banda, l'isòtop radioactiu Sm-135 és beta emissor amb una vida mitjana de 46,3 hores, i s'empra en tractaments de càncer de pulmó, pròstata i pit.