UNIVERSITAT DE BARCELONA
Química Inorgànica

Notícies Inorgàniques

Any 11, Núm. 58, Febrer de 2012

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

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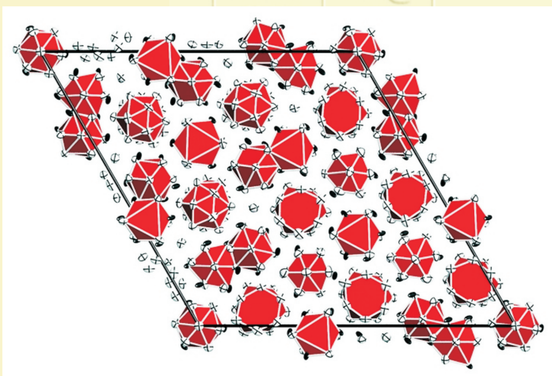
Més llum sobre el procés cloro-àlcali

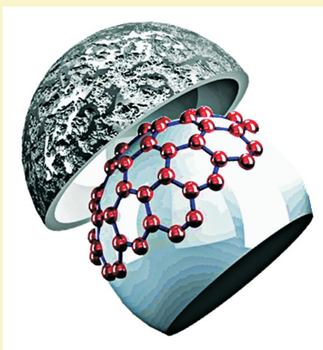
The sodium-mercury amalgam formed at the mercury cathode in the chlor-alkali process is $Na_{11}Hg_{52}$, with the sodium and mercury atoms bound in a variety of polyhedra (*Angew. Chem. Int. Ed.*,**2012**, *51*,1). The century-old chlor-alkali process uses electrolysis cells to produce NaOH and Cl_2 from brine. As the process runs, some sodium metal dissolves in the mercury, forming a solution of the solid amalgam in the liquid metal. The amalgam had defied characterization, but now Constantin Hoch of the University of Stuttgart and Arndt Simon of the Max Planck Institute for Solid State Research, both in Germany, have isolated single crystals of the amalgam and identified them as $Na_{11}Hg_{52}$. The crystal structure shows the Na atoms coordinated by Hg atoms in four classes of polyhedra, with Na–Hg distances ranging from 3.14 to 3.76 Å. The large difference in electronegativity between Na and Hg means that the bonds are more polar than those in classic metallic compounds, making the amalgam an interesting system for further study, Hoch and Simon report.



Projection of the unit cell enphasizing the distorted hexagonal close packing of the polyhedra around different types of Na.

El grafit lubrifica les pròtesis

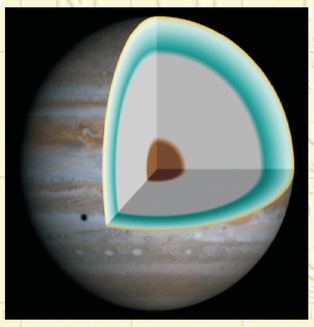
The lubricant that forms to lessen friction in metal-on-metal hip replacements is made of a thin, graphitelike layer of carbon, not protein as researchers suspected (*Science*, **2011**, *334*, 1687). That surprise might pave the way for long-lasting implants. Ball-and-socket-shaped hip prostheses can be made from several different materials, including metal, plastic, and ceramics. The types thought to wear the least with time are metal-on-metal implants, with both ball and socket made from an alloy. But certain metal-on-metal implants trigger pain and inflammation and must be replaced. To better understand what happens in an implanted metal-on-metal hip, materials scientist L. D. Marks of Northwestern University, orthopedic surgeon J. J. Jacobs of Rush University Medical Center, and colleagues focused on the joint's surface, which is a hot spot for friction and wear. Marks's team scraped some of the lubricating layer from seven implants that had been removed from patients and took a close look with electron microscopy, electron energy loss spectroscopy, and Raman spectroscopy. The researchers concluded that the lubricant's major component is graphitic carbon. It's not clear how the graphitic material forms, they say. The experts think the work could lead to artificial hips that take longer to deteriorate.



Artist's rendition of graphitic material on the surface of a metal-on-metal hip implant.

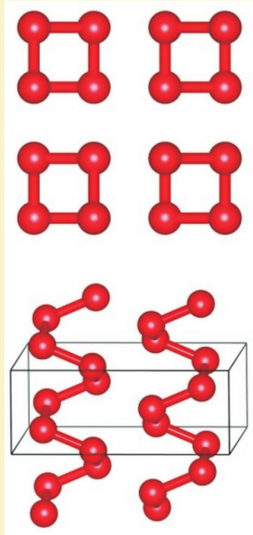
Calen 10^9 atm per tenir hidrogen metàl·lic...

For over a century, scientists have said it should be possible to turn hydrogen into a metal. Now, chemists in Germany claim to have finally performed the feat, although others remain sceptical. In the late 19th century, chemists pointed out that hydrogen, topping the column of alkali metals in the periodic table, ought to form a metal itself. The challenge of metallic hydrogen is alluring, partly because it has the potential for some exciting applications. Some believe studies of the material could lead to a room temperature superconductor, which would enable lossless power transmission. And if it is shown to be metastable, metallic hydrogen - being far denser than normal hydrogen - might make an efficient rocket fuel. M. Eremets and I.Troyan, *Nat. Mater.*, **2011**, *10*, 927, now believe they are the first to offer conclusive evidence for metallic hydrogen. They condensed hydrogen in the hole of an alumina-epoxy gasket, which sat inside a diamond anvil cell. At room temperature and 220 GPa, the researchers found that the hydrogen appeared to become opaque and electrically conductive. Then, lowering the temperature to 30 K at pressures above 260 GPa, they found that the resistance increased by 20 per cent before levelling off. They found that hydrogen conducts to the lowest measured temperatures of 30 K, and the resistance is nearly temperature independent, as it should be for metals.



This cut-away illustrates a model of Jupiter's interior. In the upper layers the atmosphere transitions to a liquid state above a thick layer of metallic hydrogen. In the center there may be a solid core of heavier elements.

... i potser 10^{10} atm per aconseguir O_4



Predicted square spiral-chain structure for the oxygen at high pressure

At pressures of nearly 2 TPa, molecular oxygen forms a spiral-chain O_4 structure with unusual properties, a computational study predicts (Yaming Ma et al., *Proc. Natl. Acad. Sci. USA*, **2012**, *102*, 751). The authors used a computational method known as CALYPSO (crystal structure analysis by particle-swarm optimization) to search for structures of oxygen. In the past, this method has predicted the structures of known systems. The researchers performed structural simulations over the pressure range of 0.02–2.0 TPa. The simulations predicted a previously observed molecular O_8 structure, which is stable over the pressure range 0.008–1.92 TPa. At 2 Tpa, they discovered the previously unknown O_4 structure, which forms a square spiral chain with four oxygen atoms per turn. The structure is similar to sulfur's high-pressure S_4 phase. "This spiral-chain form is the first monatomic form of oxygen. The oxygen atom is the basic constituent unit of the solid," Ma says. "All other known forms of oxygen exist in the molecular O_2 form where the basic constituent unit is the O_2 molecule." The researchers were surprised to find that the new O_4 structure is an insulator rather than a superconductor, like the low-pressure metallic O_8 phase.

Breus

• L'Oficina Internacional de Pesos i Mesures ha acceptat, finalment, una nova definició de la unitat de massa, el kilogram, desvinculada de qualsevol objecte físic com fins ara. La nova definició està relacionada amb la constant de Planck, h, les unitats de la qual són J s = kg m^2 s^{-1}, recordeu que el segon i el metre tenen valors numèrics fixats en termes de transicions entre nivells de l'àtom de Cs i la velocitat de la llum al buit, respectivament. Ara, un kilogram és el que matemàticament fa que $h = 6.6260639 \cdot 10^{-34}$ J s. Paral·lelament, s'ha proposat definir el mol com el que matemàticament fa que la constant d'Avogadro sigui $6.0221415 \cdot 10^{23}$ per mol.

•La Unió Europea ha definit un nanomaterial com aquell de mida compresa entre 1 i 100 nm. La definició, basada exclusivament en la grandària, ha estat molt criticada tant per grups mediambientals com pel món industrial.

•L'obra de Robert Boyle «El Químico escéptico» apareguda l'any 1661 i considerada el primer llibre de la química moderna, ha estat publicada en edició castellana per l'editorial Crítica.

Avui recomanem

Al You Tube podeu trobar «*Voices of Inorganic Chemistry*», una sèrie d'entrevistes a inorgànics rellevants.

L'element

El **ceri,** element número **58,** fou descobert pels químics suecs J. J. Berzelius i W. Hisinger i també, de manera independent, per l'alemany M. Klaport, el 1803. El nom fou proposat per Berzelius, en homenatge al planeta Ceres –anomenat en honor de la deessa romana de l'agricultura– descobert un parell d'anys abans.

És l'element més abundant del grup dels lantànids, representant el 0.0046% de l'escorça terrestre, una abundància semblant a la del Cu. A l'igual que els altres lantànids, els seus compostos són majoritàriament de nombre d'oxidació III, però es coneix el CeO_2, amb un poder oxidant moderat que el fa molt útil en determinacions analítiques.

Altres aplicacions d'aquest òxid són en la manufacturació de vidres com a component, agent colorant o en el seu poliment; és un component dels catalitzadors dels cotxes per reduir l'emissió de CO i NO_x Tradicionalment s'emprava en les pedres d'encenedors en ser un dels components de l'anomenat Mischmetall.

No se li coneix cap paper biològic, encara que les seves salts semblen estimular el metabolisme.