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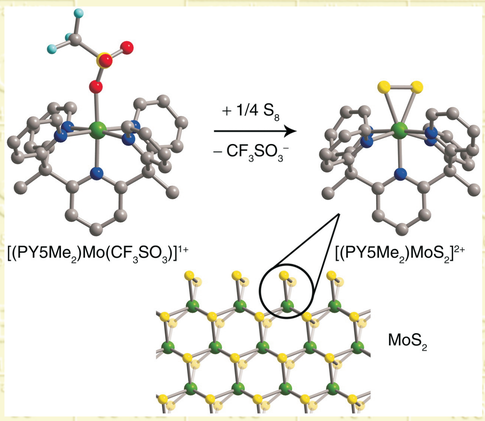
Editors: Gabriel Aullón, Ramón Bosque i Joaquim Sales. Correspondència: noticies@qi.ub.edu

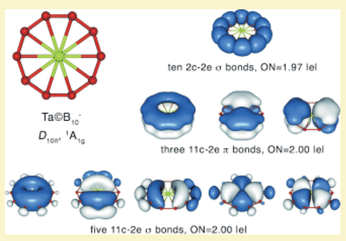
La catàlisi heterogènia inspira l'homogènia

New ways to synthesize catalytic materials for energy conversion and storage may be possible with a synthetic molecular complex that mimics the shape and reactivity of catalytically active sites in molybdenum disulfide nanoparticles. MoS_2 is well-known and thoroughly studied, because of its extensive use in the petroleum industry as a hydrodesulfurization (sulfur removal) catalyst. Several years ago, researchers in Denmark predicted and showed experimentally that MoS_2 nanoparticles can also serve as effective catalysts for the hydrogen evolution reaction, a key step in light-driven hydrogen production from water. Now, a team from the University of California, Berkeley, (C. J. Chang, J. R. Long et al. *Science*, **2012**, *335*, 698) has prepared a synthetic Mo(IV)-disulfide pentapyridyl complex that features the same type of uncommon triangular MoS_2 units found along the nanocrystal edges. On the basis of electrochemical measurements and gas chromatographic analysis of acidic organic and aqueous solutions containing the complex, including a sample of unpurified California seawater, the team concludes that the new compound serves as an effective hydrogen evolution catalyst.

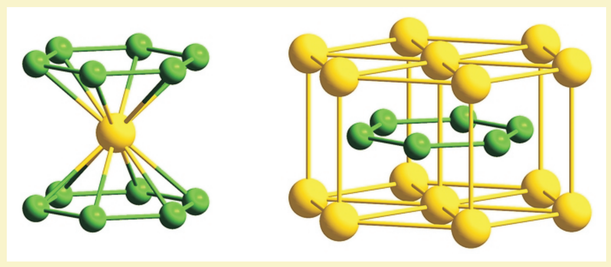


Bor polifacètic

A multi-institution research team has created wheel-like TaB_{10} and NbB_{10} clusters that set a record for the highest coordination number in any planar molecule (A. I. Boldyrev, L.S. Wang, et al. *Angew. Chem. Int. Ed*., **2012**, *51*, 2101). The authors have often teamed up to engineer seemingly impossible molecular combinations, including the previous record-holding hypercoordinated planar species RuB_9. For three-dimensional molecules, the highest coordination so far is 14. Boldyrev's group focuses on computational chemistry to determine whether the imagined molecules are physically plausible, and Wang's group generates the species by laser vaporization of a target disk containing the elements of interest and confirms their existence in the gas phase by using photoelectron spectroscopy. They found that the TaB_{10} and NbB_{10} wheels are perfect decagons (shown) and are aromatic by virtue of their delocalized sigma and pi bonds. Chemists are interested in making these materials for their superconducting or semiconducting properties. In a separate result, B. P. T. Fokwa and M. Hermus, *Angew. Chem. Int. Ed*.,**2012**, *51*, 1702, succeeded in using solid-state synthesis methods to make $Ti_7Rh_4Ir_2B_8$, which contains a planar B_6 ring as a building block. This is the first example of an isolable compound containing a planar all-boron ring.



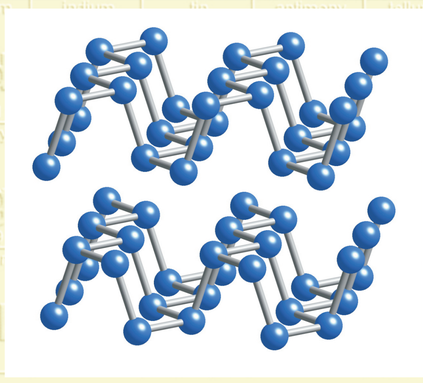
The computed structure and aromatic molecular orbitals for TaB_{10}^-.



This crystal structure image shows coordination of a planar B_6 ring to titanium atoms in the solid $Ti_7Rh_4Ir_2B_8$. (Rh and Ir are omitted for clarity.)

L'arsènic tan negre com el fòsfor?

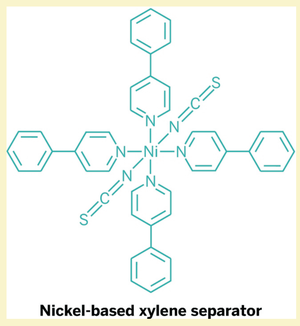
Phosphorus and arsenic are on top of each other in one group of the periodic table, so they have many similar properties. In addition to tubular forms, phosphorus is found in white, red, black, and purple structural forms. At room temperature, black phosphorus is the stable form; the others are metastable. According to textbooks, arsenic occurs in gray, yellow, and black forms. However, the existence of black arsenic, which should be analogous to black phosphorus, has never been indisputably proven. Researchers have now demonstrated that black arsenic is metastable in its pure form, and that it has thus far only been obtained in a form stabilized by atoms of other elements (T. Nilges, R. Weihrich, P. Schmidt, et al. *Angew. Chem. Int. Ed*. **2012**, *51*, 2994). The researchers used gas-phase reactions to study phase formation. In these reactions, the solids are heated and the resulting pressure, which builds through sublimation of particles from the solid, is measured. Particles from a metastable phase enter the gas phase much more easily, so the pressure is higher than for a stable phase. When a metastable phase converts to a stable phase, the drop in pressure can be observed. It is even possible to observe pathways involving multiple different metastable intermediates. The researchers were thus able to identify all metastable and stable phases of solid solutions of arsenic and phosphorus in all possible ratios. They were thus able to demonstrate that black arsenic is metastable in its pure form.



Estructura cristal·lina del fòsfor negre

El níquel separa xilens

Exposing a crystalline nickel complex to xylene vapor is a simple yet promising method for separating xylene's three structural isomers, (M. Lusi, J. Barbour, et al. *Angew. Chem. Int. Ed*. **2012**, *51*, 3928). Xylenes, or dimethylbenzenes, are derived together from petroleum and used collectively or separately as solvents or as commodity feedstocks. However, the isomers are difficult and expensive to separate by conventional methods, which include filtration using porous solids, distillation, and crystallization. The authors found that a nickel complex bearing phenylpyridine and isothiocyanate ligands (shown) readily absorbs the isomers independently via host-guest complexation to form clathrate compounds. But in comparative experiments they found that the complex thermodynamically favors *o*-xylene over *m*-xylene and *p*-xylene, and *m*-xylene over *p*-xylene. For instance, when the material is exposed to a vapor of all three isomers, it binds *o*-xylene. Once the *o*-xylene is desorbed by heating, and the nickel complex is reexposed to the remaining vapor, the material then binds *m*-xylene. The researchers believe that with fine-tuning the material could be useful for industrial-scale separation of xylenes.



Nickel-based xylene separator

Breus

• La IUPAC ha confirmat el descobriment dels elements de nombre atòmic 114 i 116. Per al 116 es proposa el nom de flerovi i símbol Fl; en record de Georgy N. Flerov (1913-1990), físic rus descobridor de la fissió espontània de l'urani, el 1940. El 116 rebrà el nom de livermori i símbol Lv, pel nom de la ciutat californiana on es troba el Lawrence Livermore National Laboratory, centre reconegut per la preparació d'elements superpesants.

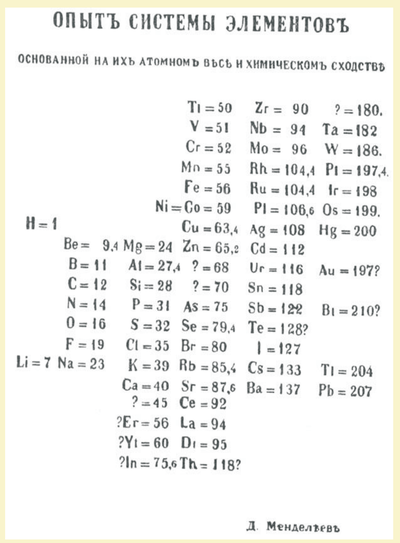
•Les fortes retallades del Govern espanyol als pressupostos de recerca han estat denunciades a nivell internacional. *Chem. Eng. News*, **2012**, *80 (13)*, 40.

•Els algorismes que far servir Google per prioritzar les pàgines web en el seu buscador ("PageRank") han demostrat ser útils també per analitzar el comportament de dissolucions que tenen enllaços d'hidrogen (*J. Comp. Sci*. **2012**, *33*, 853)

Avui recomanem

La Universitat Hebrea de Jerusalem i l'Institut Tecnològic de Califòrnia han posat en marxa un web que conté més de 80.000 documents sobre tots els aspectes de la vida d'Albert Einstein. www.alberteinstein.info

L'element


ОПЫТЪ СИСТЕМЫ ЭЛЕМЕНТОВЪ

ОСНОВАННОЙ НА ИХЪ АТОМНОМЪ ВѢСѢ И ХИМИЧЕСКОМЪ СХОДСТВѢ

			Ti = 50	Zr = 90	? = 180.	
			V = 51	Nb = 94	Ta = 182	
			Cr = 52	Mo = 96	W = 186.	
			Mn = 55	Rh = 104,4	Pt = 197,4.	
			Fe = 56	Ru = 104,4	Ir = 198	
			Ni = Co = 59	Pl = 106,6	Os = 199.	
H = 1			Cu = 63,4	Ag = 108	Hg = 200	
	Be = 9,4	Mg = 24	Zn = 65,2	Cd = 112		
	B = 11	Al = 27,4	? = 68	Ur = 116	Au = 197?	
	C = 12	Si = 28	? = 70	Sn = 118		
	N = 14	P = 31	As = 75	Sb = 122	Bi = 210?	
	O = 16	S = 32	Se = 79,4	Te = 128?		
	F = 19	Cl = 35	Br = 80	J = 127		
Li = 7	Na = 23	K = 39	Rb = 85,4	Cs = 133	Tl = 204	
		Ca = 40	Sr = 87,6	Ba = 137	Pb = 207	
		? = 45	Ce = 92			
		?Er = 56	La = 94			
		?Yt = 60	Di = 95			
		?In = 75,6	Th = 118?			

Д. Менделѣевъ

Taula periòdica de Mendeléiev que conté «l'elment» didimi.

El **praseodimi,** element número 59, fou descobert pel químic austríac Carl F. Auer von Welsbach el 1885; aconseguí separar de l'òxid de didimi dos elements diferents el praseodimi i el neodimi. Durant alguns anys el *didimi* fou considerat un element i així és recollit a les primeres taules periòdiques de Mendeléiev. El nom prové del grec *prasios didimos*, que vol dir bessó verd.

Té les propietats químiques dels lantànids i pràcticament tots els seus compostos deriven de l'ió Pr(III), de color verd en solució aquosa, encara que es coneixen PrF_4 i PrO_2, que tenen un caràcter oxidant molt fort i desprenen oxigen de l'aigua. La combustió directa de l'element a l'aire dóna Pr_6O_{11}. No és un element gaire abundant i acostuma a representar un 5% dels minerals típics dels lantànids. L'ió Pr(III) s'empra en RMN com agent de desplaçament químic.

Les principals aplicacions de l'element són la fabricació d'aliatges lleugers i imants; els seus compostos s'usen per donar color groc a vidres i esmalts. Com la resta de lantànids no s'han descrit cap paper biològic i té una toxicitat moderada.