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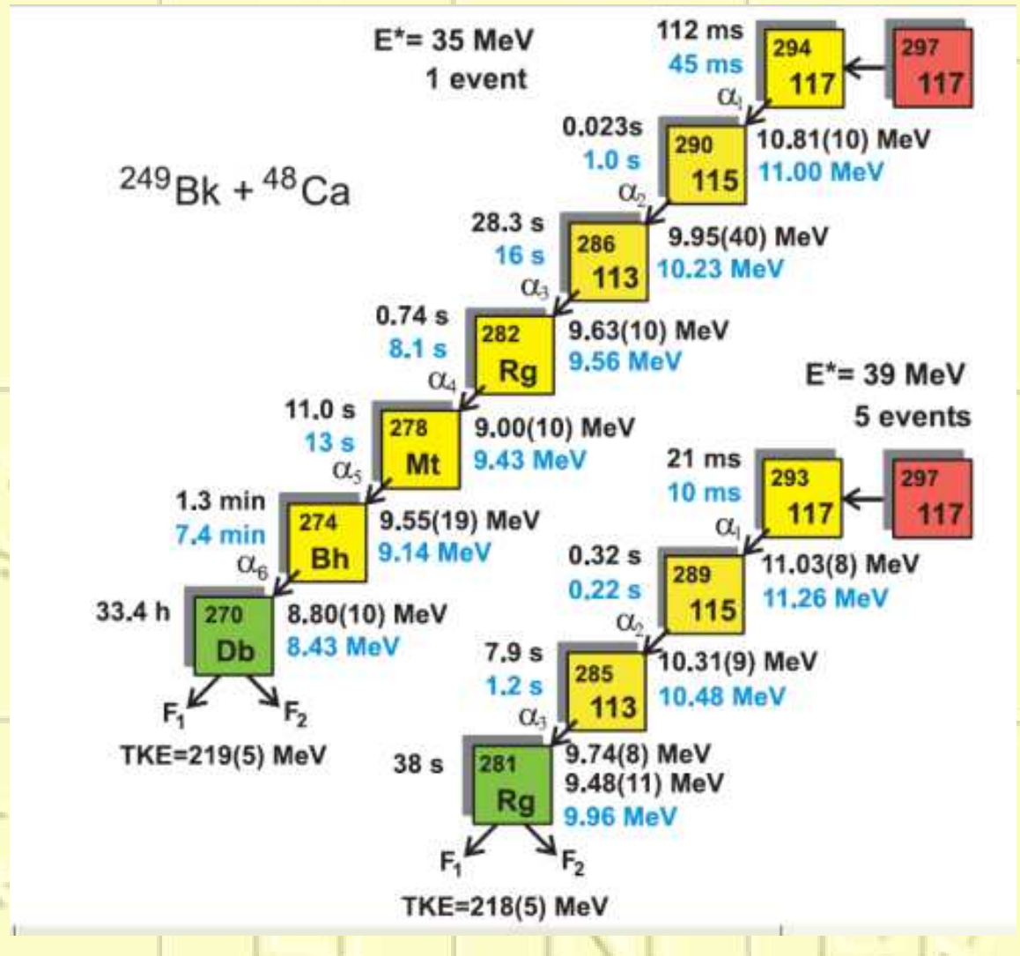
El Uus completa el setè periode

Scientists report they have created the especially shifty superheavy element 117, a milestone for nuclear chemistry that now completes the seventh row of the periodic table (*Phys. Rev. Lett*. **2010**, *104*, 142502). The discovery helps clarify the still-fuzzy picture of the behavior of extremely heavy elements. It also bolsters the case for the existence of an "island of stability," where a cluster of superheavy elements that have very long half-lives holds out to scientists the tantalizing prospect of doing superheavy-element chemistry.

Yuri Oganessian, director of the Flerov Laboratory of Nuclear Reactions at the Joint Institute for Nuclear Research, in Dubna, Russia, led the international team. With a particle accelerator at Dubna, the group repeatedly smashed calcium-48 into a target coated with the radioactive berkelium-249. In rare instances, the two elements fused to produce two isotopes of the new superheavy element, $^{293}117$ and $^{294}117$. They identified element 117 from its characteristic decay chains.

Like its cousin elements 116 and 118—which have already been created—element 117 has isotopes with half-lives that are in keeping with theories of elements near the presumed island of stability, which has elements with 184 neutrons. Element 117 was more difficult to create than 116 and 118 for a number of reasons. Odd-numbered elements have more complex decay chains. In addition, the starting material ^{249}Bk has a half-life of only a year, making it difficult to coordinate experiments.

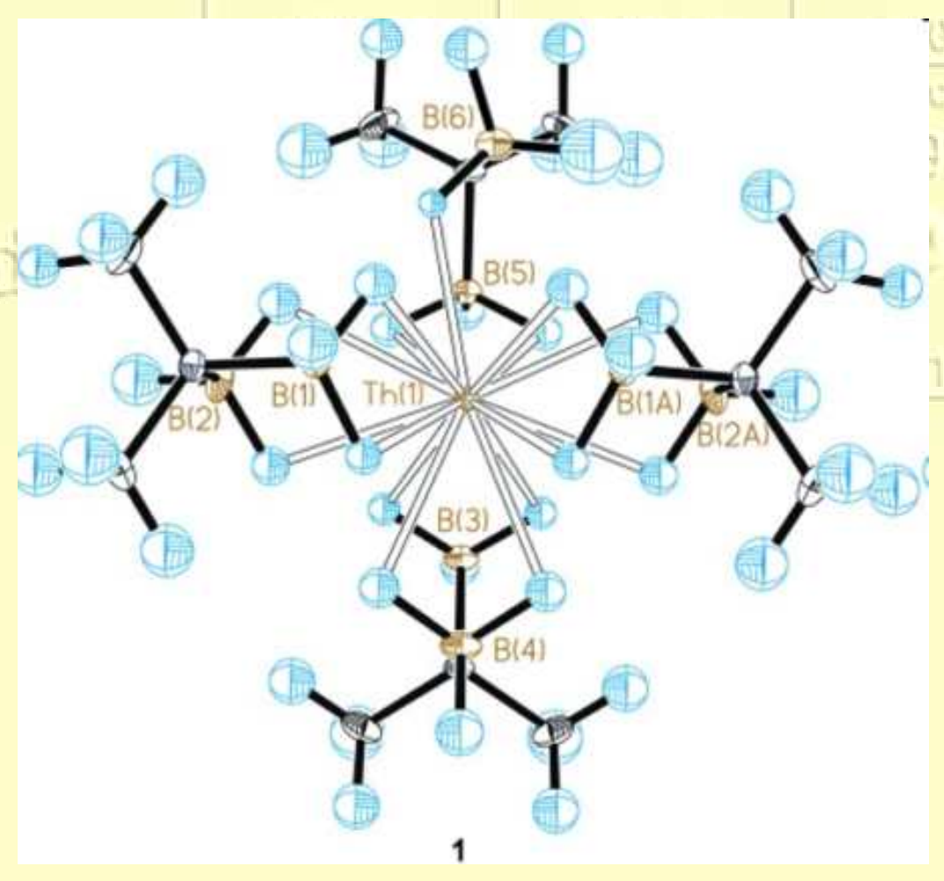


Un tori amb quinze lligands

A multidisciplinary research team has reported the first example of a stable, crystallographically characterized 15-coordinate metal complex, an achievement that extends the boundaries of chemical bonding.

The thorium aminodiboranate created by Gregory S. Girolami of the University of Illinois and colleagues bests the prior record of 14 two-electron metal-ligand bonds in complexes such as $U(BH_4)_4$. But for one errant hydrogen atom, the molecule's metal could have had 16 bonds, the theoretical maximum based on the number of atomic orbitals thorium has available for bonding; some metallocenes can have more metal-ligand contacts but at most 12 two-electron metal-ligand bonds.

The trick to reaching high coordination numbers is combining a large metal cation with small chelating ligands. The researchers accomplished that by pairing thorium, an f-block element with a large covalent radius, and hydrogen, the smallest of ligands. They made the 15-coordinate $Th[(H_3B)_2N(CH_3)_2]_4$ by treating $ThCl_4$ with $Na[(H_3B)_2N(CH_3)_2]$ in tetrahydrofuran, isolating it as colorless crystals (*Angew. Chem. Int. Ed*. **2010**, *49*, 3379).



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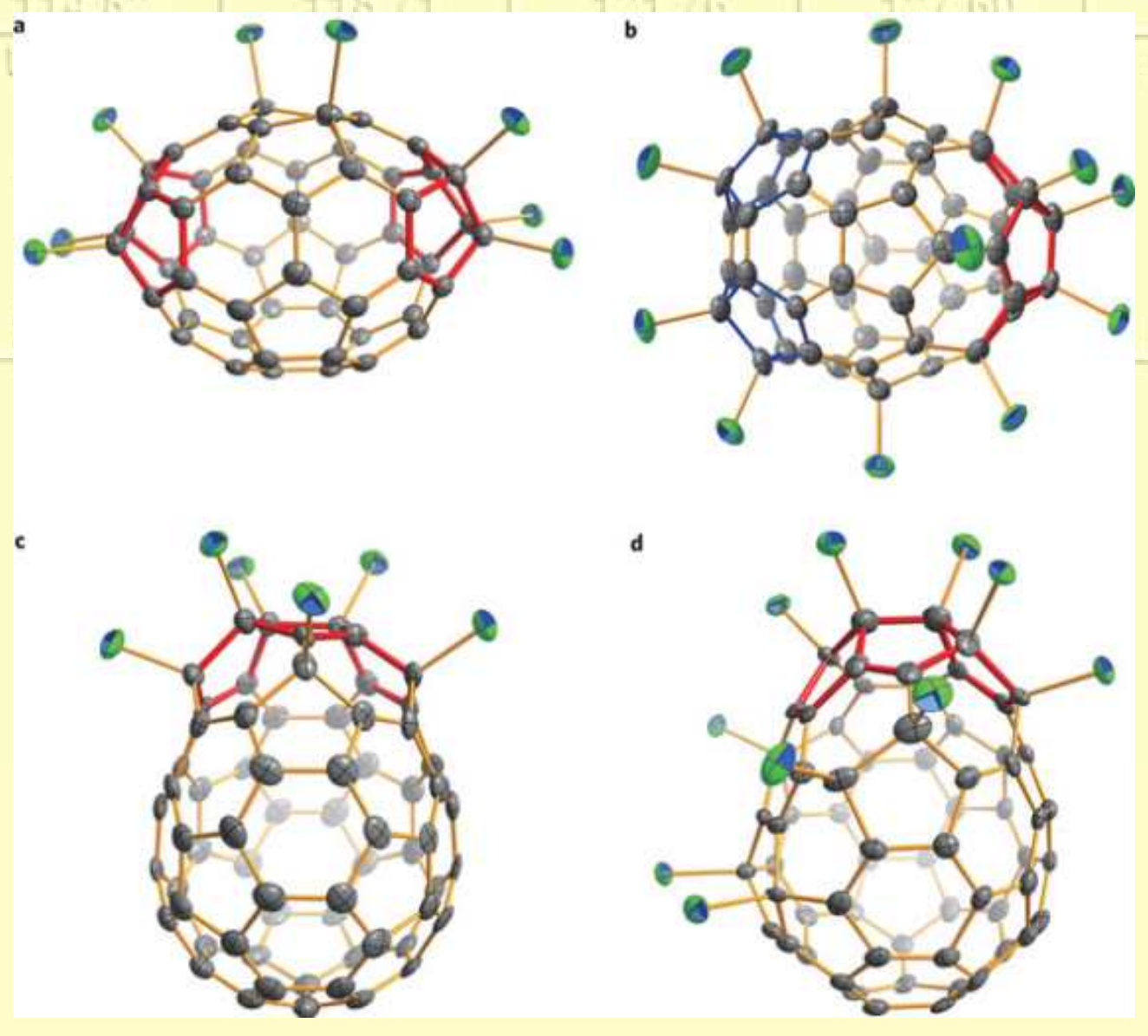
Els ful·lerens trenquen les regles

Chinese researchers have made an exotic new family of fullerenes that contain three pentagons fused sequentially in their structure (Y.Z. Tan *et al*., *Nature Chemistry* **2010,** *2*, 269). Unlike classical fullerenes, such as the soccer ball-shaped buckminsterfullerene (C_{60}) - the new compounds bulge out in unusual egg-shapes. It is hoped that these new structures might help reveal some of fullerenes' mysteries.

Fullerenes are cages of carbon atoms, typically comprised of 12 pentagons and a varying number of hexagons. But in order to be stable, each pentagon must be surrounded by hexagons - known as the 'isolated pentagon rule' (IPR). The IPR is a very strong rule of thumb for neutral bare fullerenes, where every adjacent pentagon costs about 100 kJ/mol in stability. However, the rule can be overcome by adjusting the electron count in the structure, either by encapsulating other species, such as metal ions, or functionalising the carbon atoms on the surface.

Here, the secret was adding chlorine substituents to relieve some of the strain caused by adjacent pentagons. The researchers at Xiamen University vapourised graphite in an arc-discharge reactor in the presence of carbon tetrachloride (CCl_4), which produced 3g of fullerene-rich soot every hour. This was then painstakingly purified and separated by several stages of high performance liquid chromatography.

Four new fullerenes were identified: $C_{54}Cl_8$, which contains two sets of triple sequentially-fused pentagons; $C_{56}Cl_{12}$, which has one set of triple sequentially-fused pentagons and two sets of double-fused pentagons; and two larger fullerenes, $C_{66}Cl_6$ and $C_{66}Cl_{10}$, which each contain a single set of triple sequentially-fused pentagons.



Memòria superelàstica

A unique iron-based polycrystalline alloy can recover its shape after experiencing about twice the superelastic strain of being bent or twisted than any other polycrystalline shape-memory alloys, Japanese scientists report *(Science* **2010,** *327*, 1488).

Traditional alloys that can be bent and return to their original shape include Ni-Ti and Cu-Zn-Al. In particular, Ni-Ti is a valuable material for medical applications such as stents and frames for eyeglasses. Ryosuke Kainuma and colleagues at Tohoku University developed the new alloy, with a composition of Fe-Ni-Co-Al-Ta-B. In addition to its superelastic strain of 13%—compared with 7% for Ni-Ti alloys—the material is exceptionally strong. It also has a high damping capacity and can reversibly change its magnetization when stressed and unstressed.

Breus

- Es compleixen 75 anys de la invenció del Nylon, que va donar inici a la industria de fibres sintètiques (*Chem. Eng. News*, 12 d’abril de 2010)
- 50 anys després, es comença a esbrinar el mecanisme d’actuació de la talidomida, medicament que va ser responsable de malformacions en més de deu mil nadons (*Chem. Eng, News*, 11 de març de 2010).
- Una nova tecnologia, basada en l’aplicació de càrregues elèctriques a les gotes de tinta, permet fer impressions de mida nanomètrica (*Chem. Eng. News*, 25 de gener de 2010).

Avui recomanem

JACS Image Challenge, un passatemps que us permet posar a prova els vostres coneixements de química i d’anglès

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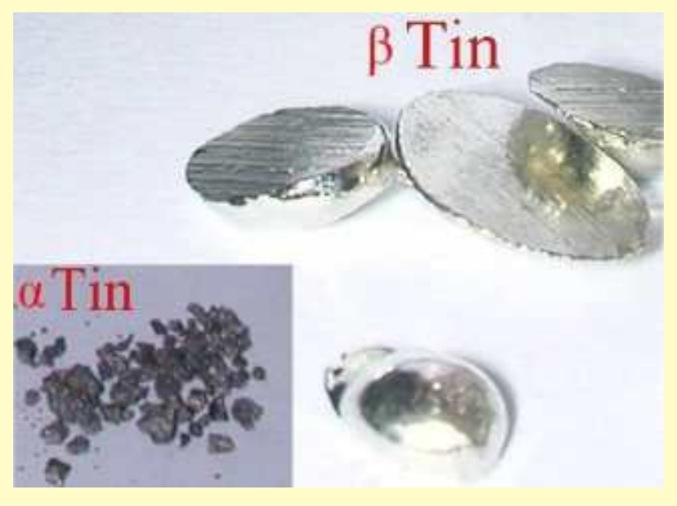
L’element



L'element número **50**, **estany**, és conegut des de l'antiguitat i s'han trobat estris de bronze – aliatge de coure i estany – del 3.500 a C. El nom prové del llatí *stannum* però té un origen incert, possiblement relacionat amb el terme anglès, *tin*. El mineral principal és la cassiterita, SnO_2. S'utilitza en molts aliatges i en les llaunes de conserves i begudes. Els derivats organo-metàl·lics s'han emprat en pintures de vaixells, però generen molts problemes de contaminació.

Presenta dues formes al·lotròpiques, la forma β (estany blanc) d'estructura metàl·lica, estable a temperatura ambient o superior, es transforma a la forma α (estany gris) amb estructura tipus diamant, per sota dels 13ºC. Aquesta transformació, més ràpida a temperatures baixes, és coneguda com la malaltia de l'estany, i produeix el trencament de tubs d'orgue els hiverns molt durs. Una llegenda urbana, atribueix a aquest fet la desfeta de les tropes de Napoleó a Rússia, en el sentit que les temperatures extremadament baixes trencaren els botons dels uniformes dels soldats francesos.