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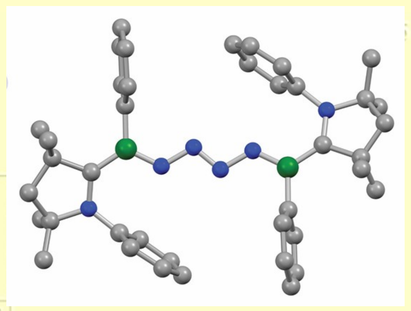
http://www.ub.edu/inorgani/dqi.htm

El bor acobla dos N_2

Dinitrogen tends to be a loner. Extreme conditions, such as intense radiation in the ionosphere, are needed to coerce two or more N_2 molecules to form chains. Various pharmaceuticals and explosives made by humans contain three- and four-atom nitrogen chains. To make these compounds, chemists have to use an indirect route. They first split dinitrogen through a high-temperature and high-pressure industrial process to produce ammonia and amines. Then they stitch together those N_1 compounds into the nitrogen chains. A new study describes a direct and gentle way to make compounds with nitrogen chains using dinitrogen. A team report that an organoboron compound can stitch together two N_2 molecules under near-ambient conditions to form a complex in which an N_4 chain bridges two boron moieties (M.A. Légare, et al., *Science* **2019**, DOI: 10.1126/science.aav9593).

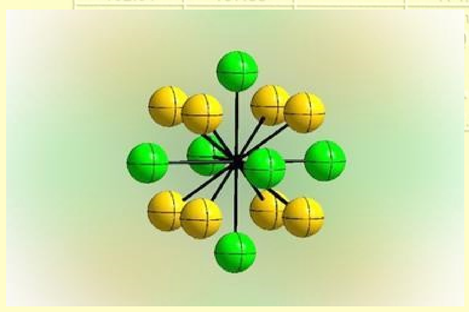
The team made the new nitrogen-chain complex by first synthesizing a dihaloorganoborane precursor via standard methods and then reducing it with a solution of KC_8 in the presence of dinitrogen at roughly 4 bar (four times atmospheric pressure) and –30 °C. X-ray crystallography revealed the entire structure to be planar, suggesting a delocalised π electron network. The N unit resembles an organic tetrazene with the central N–N bond a classic double bond and the terminal N–N linkages closer in length to single bonds.



Ratificada l'estructura cristal·lina del F_2

Fifty years after fluorine's crystal structure was first determined (L Meyer et al, *J. Chem. Phys.*, **1968**, 49, 1902 (DOI: 10.1063/1.1670323) –in experiments that involved explosions and midnight liquid helium handling– the element's structure has finally been given a second look. In the process, a team has managed to solve a controversy surrounding the frozen halogen's crystal symmetry (S. Ivlev et al, *Chem. Eur. J.*, **2019**, 25, 3310 (DOI: 10.1002/chem.201805298).

The authors of the 1968 study had suggested two possible crystal symmetries – space groups C2/m and C2/c. Without their knowledge, Nobel prize laureate Linus Pauling had reinterpreted their data in 1970, suggesting C2/c to be much more likely. With their new measurements, the team could finally settle once and for all which of fluorine's low temperature polymorphs was the correct one.

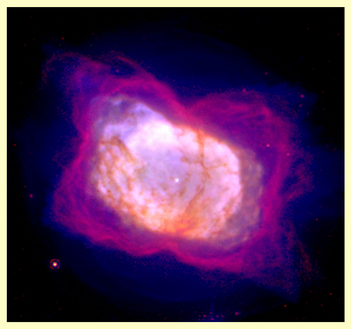


A section of the crystal structure of fluorine. The F1 atoms forming the cube are drawn yellow, the F2 atoms forming the octahedron are drawn in green.

Detectat per fi l'ió HeH^+

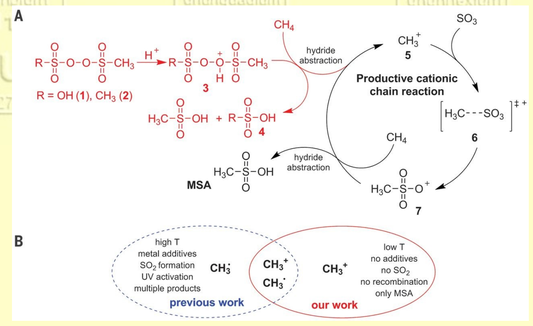
Around 380,000 years after the big bang, the plasma that was our universe cooled enough for nuclei and electrons to begin combining. Helium was the first atom, and helium atoms soon bonded with protons to make the universe's first molecule, helium hydride (HeH^+).

While chemists made HeH^+ in the laboratory as early as 1925, it wasn't until the 1970s that scientists suggested it might be found in interstellar space. Four decades later, astronomers report they have finally observed it (R. Güsten et al., *Nature* **2019**, DOI: 10.1038/s41586-019-1090-x). What they're seeing may change models of chemical reactions in space. Astronomers identified a spectral line characteristic of HeH^+ in observations of the planetary nebula NGC 7027, one of the places HeH^+ was thought likely to be found. The nebula's HeH^+ is not left over from the primordial universe. Planetary nebulae form after stars similar in size to our sun collapse, ejecting a shell of gas and leaving a white dwarf star at its center.



L'àcid sulfúric activa el metà

Researchers have developed a method to convert methane to methanesulfonic acid (MSA) with a yield and selectivity of nearly 100% (C. Díaz-Urrutia et al, *Science* **2019**, DOI:10.1126/science.aav0177). The procedure, which involves just two reactants—methane and oleum (a solution of sulfur trioxide in sulfuric acid)—may provide a low-cost route to MSA, a biodegradable strong acid manufactured at the multi-metric-ton level for use in the pharmaceutical and electroplating industries. For years, researchers have worked to develop energy- and cost-effective methods for converting the gas to easily transported liquids. Several commercial processes for transforming methane to methanol, hydrocarbons, and other liquids already exist. But most of those methods require costly metal catalysts and start by converting methane to synthesis gas, a mixture of CO and hydrogen, which requires high temperatures and tends to be economical only at very large scales. Now, the researchers came up with a low-temperature (50 °C) metal-free route. The team explains that a protonated sulfonyl compound, a peroxonium ion, initiates the reaction via hydride abstraction from methane, generating a CH_3^+ ion. CH_3^+ reacts with SO_3 to produce $CH_3SO_2O^+$. That cation also reacts with methane via hydride abstraction, yielding MSA and regenerating a reactive CH_3^+ ion.



Breus

- El diferent enfosquiment observat en algunes zones grogues del quadre "Les Senyoretes d'Avinyó" pintat per Picasso l'any 1907, és degut a la diferent mida de les partícules de CdS presents en la pintura groga emprada (D. Comelli et al, *Anal. Chem.*, **2019**; DOI:10.1021/acs.analchem.8b04914)
- Els residus de sulfat de calci hidratat (phosphogypsum) produïts en la fabricació de fertilitzants a partir de fosfats, permeten la recuperació de diversos elements del grup dels lantànids, imprescindibles en la fabricació de molts dispositius electrònics (R.E. Riman et al, *J. Chem. Thermodynamics* **2019**; DOI: 10.1016/j.jct.2018.12.034)
- Estudis recents permeten proposar que la diferent proporció de carboni, nitrogen i sofre en la terra en relació a meteorits i roques del sistema solar, és deguda a la col·lisió produïda per un objecte de la mida del planeta Mart, amb la terra (R. Dasgupta et al, *Sci. Adv.* **2019**; DOI:10.1126/sciadv.aau3639).

Avui recomanem

Dins del *IYPT 2019* les deu Taules Periòdiques que s'han de conèixer, segons Chemistry World: The biggest (permanent); the smallest; the oldest; the edible; the macramé; the most expensive (probably); the "atòmic clock"; the periodic conference table; the periodic table of endangared elements; the original. (Emma Stoye, "Ten periodic tables you really should know about". *Chemistry World, News*, 18 April 2019). No oblideu de continuar consultant a twiter #1TPdia, de la Societat Catalana de Química.

L'element

L'element número 87, **franci**, fou descobert l'any 1939 per Marguerite Perey, investigadora de l'Institut Curie, com a producte de descomposició de l'actini en emetre una partícula α. És un dels elements predits per Mendeleiev l'any 1871. Abans de la confirmació oficial del seu descobriment s'havien fet fins a quatre intents els anys 1925, 1926, 1929 i 1937, amb els noms de "russium", "alcalinium", "virginium" i "moldavium", respectivament. Perey li posà franci en honor al seu país, que passà així a ser el segon element, després del gal·li, a tenir un nom referit a França.

Es troba en traces en les menes d'urani i de tori, on el ^{223}Fr està formant-se i desintegrant-se contínuament. La quantitat de ^{223}Fr a l'escorça terrestre en un moment donat possiblement no passa dels 30 grams. Es pot sintetitzar a la reacció nuclear:

$^{197}Au + {}^{18}O \rightarrow {}^{210}Fr + 5n$

Aquest procés genera isòtops de franci amb masses de 209, 210 i 211.

És l'element més inestable dels presents a la terra, el ^{223}Fr, l'isòtop més estable té una vida mitjana de 21,8 minuts. Es coneixen 34 isòtops amb unes masses compreses entre 199 i 232. Té unes propietats físiques i químiques característiques dels alcalins, i no se li coneix cap aplicació.