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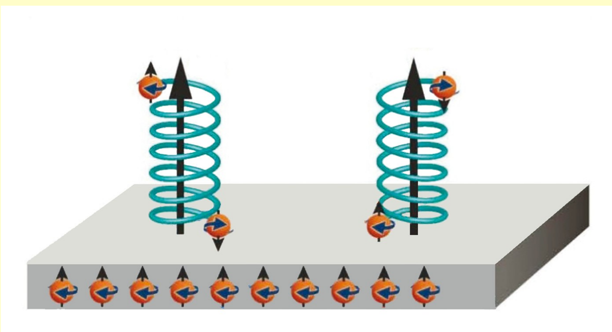
Els camps magnètics resolen enantiòmers

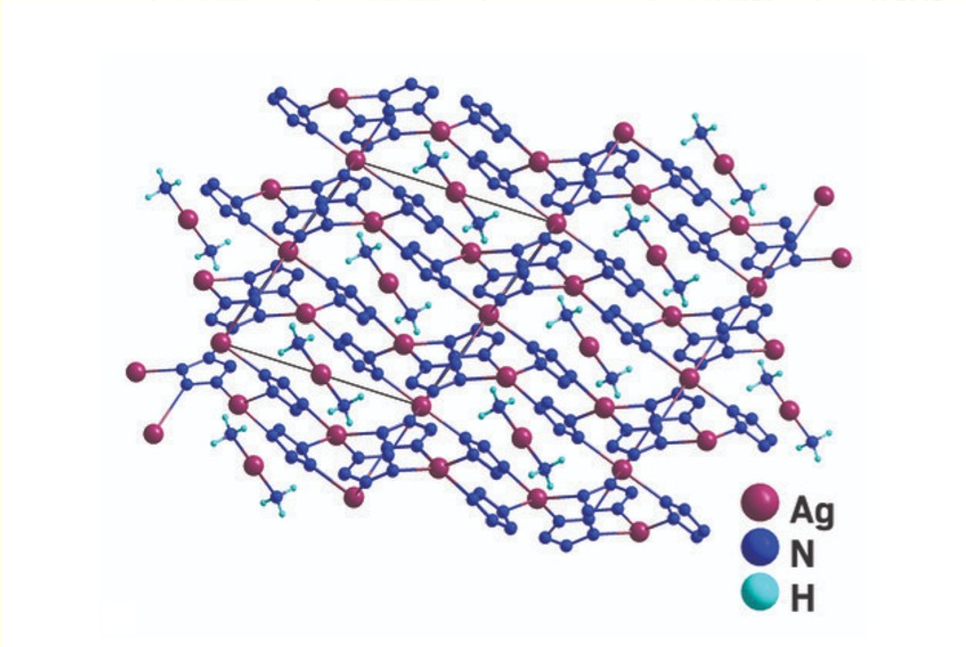
A team has reported that magnetic fields could separate enantiomers in a racemic mixture (R. Naaman et al., *Science*, **2018**, DOI:10.1126/science.aar4265). This effect is possible because electrons don't behave the same way in one enantiomer as they do in another. In a chiral molecule, the spin states affect electron motion. Electrons in one spin state will move more easily than those in the other state. When molecules approach a surface, they become polarized, which involves electrons moving through the molecule, if the molecule is chiral, electrons with one spin state are more favored to move than those in the other state. That causes a concentration of electrons in one spin state where the molecule interacts with the surface. If the surface is magnetized, the spin states of the material's electrons will align parallel to the magnetic field. Electrons with like spin states repel each other. A chiral molecule approaching the surface will either be attracted or repelled depending on the spin state of the electrons that concentrated at the end facing the surface. As a result, the researchers say, one enantiomer will preferentially adsorb to a magnetized surface, while the other chiral molecule will not.



Electrons with different spins (small arrows) have concentrated at the bottom faces of two enantiomers (blue coils). Near a surface magnetized in the upward direction (big arrows), the enantiomer on the left is more likely to adsorb because the electrons on its face have opposite spins from those on the surface.

Un «pentazolat» estable

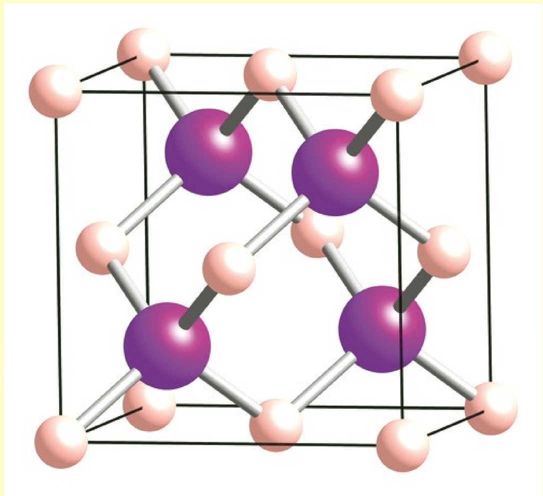
The pentazolate anion —a five-membered ring composed only of nitrogen atoms —has great potential as a high-energy-density material for explosive or propulsive applications. But chemists have had to stabilize the anion with molecules or ions, such as water or ammonium, that decrease the material's overall energy density. Now a team of chemists has prepared a silver pentazolate complex that's devoid of stabilizing molecules or ions (Bingcheng Hu, et al., *Nat. Commun.*, **2018**, DOI: 10.1038/s41467-018-03678-y). The chemists prepared the naked pentazolate complex by treating a water-stabilized magnesium pentazolate salt with silver nitrate. The resulting AgN_5 is stable up to 90°C and very sensitive to impact and friction, breaking down into only Ag and N_2. However, the chemists were not able get a crystal structure of this heat- and light-sensitive, insoluble compound as a pure complex because it began decomposing to AgN_3 almost immediately after it was synthesized. So, to further characterize what they'd made, the chemists treated the AgN_5 with aqueous ammonia, which produced $[Ag(NH_3)_2]^+[Ag_3(N_5)_4]^-$. This complex was thermally stable up to 90 °C and was only moderately sensitive to impact and friction.



The unit cell of the X-ray crystal structure of $[Ag(NH_3)_2]^+[Ag_3(N_5)_4]^-$

El BAs refreda els xips

As electrons whiz around the nanosized circuits inside computer chips, they generate a lot of heat. And that waste heat creates a major headache for the electronics industry. One solution could be working with materials that conduct heat more readily. Now three teams of researchers, in separate papers, report that a semiconductor, boron arsenide, has a thermal conductivity far greater than other commonly used electronic materials (*Science*, **2018**, DOI: 10.1126/science.aat5522, 10.1126/science.aat7932, and 10.1126/science.aat8982). All three teams synthesized BAs crystals and measured the semiconductor's thermal conductivity to be at least 1,000 watts per meter per kelvin (W m^{-1} K^{-1}) at room temperature. The measured values are nearly 10 times that of the most common semiconductor, silicon, which has thermal conductivity of about 150 W m^{-1} K^{-1}.The only known material with a higher thermal conductivity is diamond, with a value of 2,000 W m^{-1} K^{-1}. But diamond is expensive, difficult to work with, and not a semiconductor.



El AgS dúctil

To build electronic devices that can bend, fold, or stretch, engineers need flexible electronic materials. But they have far fewer options when it comes to semiconductors. Brittle inorganic semiconductors tend to crack under strain, while ductile organic semiconductors offer relatively poor electronic performance. A team of researchers has now found that a form of silver sulfide (α-Ag_2S) not only boasts promising electronic properties but also is the first known inorganic semiconductor that is ductile at room temperature (*Nat. Mater*., **2018**, DOI: 10.1038/s41563-018-0047-z). The team used density functional theory calculations to understand the atomic origins of the material's ductility, providing a possible general approach to discover other flexible semiconductors for applications such as biosensors or optoelectronics. The discovery came by accident when a team member tried to prepare a sample of α-Ag_2S for X-ray powder diffraction. Rather than forming a powder when pounded in a mortar, the material simply deformed like a metal. The researchers tested how the material responded to compression, bending, and stretching and found that it could deform much more than typical semiconductors—by about 4% under tension and more than 50% under compression, values similar to many metals.

A cylinder of ductile silver sulfide (top) can take a hammering without cracking (bottom, series of hammered cylinders from left). .

Breus

- Molècules orgàniques a dojo, a l'espai. El robot de la NASA, Curiosity, ha trobat compostos orgànics atrapats en roques formades fa més de 3000 milions d'anys a Mart, de quan al planeta hi havia un llac que, potencialment, podia contenir éssers vius. S'han identificat tiofens i altres molècules amb sofre, que possiblement provinguin de molècules més grans (*Science*, **2018**, DOI:10.1126/science.aas9185). Paral·lelament, la sonda Cassini ha detectat a Encèlad, un satèl·lit de Saturn, molècules d'un pes molecular de l'ordre de 200, que podrien contenir hidrocarburs insaturats, anells aromàtics, carbonils, hidroxils, etc. (*Nature*, **2018**, DOI: 10.1038/s41586-018-0246-4). La nau espacial New Horizons ha descobert a Plutó dunes formades, majoritariament, per metà (*Science*, **2018**, DOI: 10.1126/science.aao2975.
- L'abundància relativa de C-12 i C-13, permet distinguir entre les tòfones naturals i les manipulades artificialment, ajudant així a desenmascarar un frau alimentari, ja que aquests fongs tenen un preu d'uns 7000 € el kilo (*Anal. Chem.*, **2018,** DOI: 10.1021/acs.analchem.8b00386).

Avui recomanem

Un sistema de realitat virtual que permet interaccionar amb models moleculars tridimensionals flexibles i manipular les molècules com si fossin objectes tangibles (*Sci. Adv.* ,**2018**, DOI: 10.1126/sciadv.aat2731). Al número del 6 d'agost del *Chem. Eng. News*, **96** (32), hi ha un video il·lustrador.

L'element

L'element número 84, **poloni**, fou descobert per Marie i Pierre Curie, l'any 1898 a París, quan estudiaven la radioactivitat en minerals d'urani, principalment pechblenda, que en contenen uns 100 micrograms per tona. Inicialment s'anomenà *radi F*, però posteriorment s'adoptà el nom de poloni, a instàncies de Madame Curie que volia denunciar la situació del seu país. En aquells temps, Polònia no existia com a tal i estava sota el domini de Rússia, Alemanya i l'Imperi Austrohongarès; fou, així, el primer element que encetà una controvèrsia política, pel seu nom.

Es coneixen més de 33 isòtops, tots radioactius, amb uns pesos atòmics compresos entre 188 i 220. El més estudiat és el ^{209}Po, amb una vida mitjana de 102 anys, que es prepara bombardejant bismut o plom amb partícules α, en un sincrotró. Està considerat la substància més mortífera coneguda, la màxima quantitat permesa pel cos humà es 7 picograms, fet que el fa un bilió de vegades més tòxic que el cianur d'hidrogen. L'any 2006, assolí un gran ressò mediàtic quan Alexander Litvinenko, antic agent del KGB rus que s'havia passat al servei d'intel·ligència britànic, MI6, fou enverinat per ^{210}Po.