

forced researchers to look beyond Li-ion technology, the storage capacity of which is fundamentally limited. One type of battery currently in development is based on the use of sulfur as a cathode and lithium metal as an anode. Sulfur is very cheap and abundant, and such Li-S batteries can theoretically store around five times more energy (when compared by weight) than Li-ion batteries.

Now, Arumugam Manthiram and colleagues at the University of Texas have made progress in tackling one of the problems hindering the use of Li-S batteries — lithium–metal anode degradation; an issue that affects their stability and causes safety concerns. In typical Li-S batteries, the lithium metal anode is prone to forming dendrites during cycling and can also participate in parasitic side reactions with the organic electrolyte. One way to side-step this issue is to use a lithium-free anode and a Li_2S cathode; however, with this set-up a high voltage must be applied when the battery is initially charged. This is done to overcome a potential barrier associated with the nucleation of the polysulfide phase that forms during charging, but it has a detrimental effect on the stability of the ether-based electrolyte — and thus the battery's performance.

Manthiram and colleagues have now shown that P_2S_5 can be used as an electrolyte additive in such a system, and that this removes the need for the application of a high voltage on initial charge. The P_2S_5 additive works by improving the electrochemical activity of Li_2S , enhancing the oxidative chemistry that creates the polysulfide charging products. Promising reversible discharge capacities of approximately 800 mAh per gram of Li_2S were measured and the battery retained 83% of its capacity after 80 cycles. GA

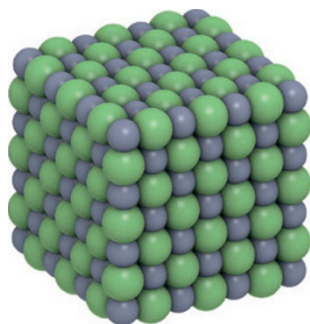
ALKALI HALIDE NANOCRYSTALS

Liquid helium worth its salt

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The behaviour of atoms and molecules on small length-scales is intriguing, and whether salt clusters adopt the same face-centred-cubic crystalline structure as in the extended solid (pictured) is one problem that has piqued the interest of many chemists. Previous studies carried out in the gas phase — in which alkali-metal halide clusters were formed for example by sputtering or laser ablation — have suggested that they do. Now, a team led by Paul Scheier and Andrew Ellis from Universität Innsbruck and the University of Leicester have turned to liquid helium droplets to further probe the assembly of salt nanocrystals. The researchers reacted sodium and sulfur hexafluoride (SF_6) within the droplets and

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found that face-centred-cubic structures do form, with particular stability conferred to clusters that consist of complete unit cells.

Sodium and SF_6 dopants were introduced separately into the liquid helium droplets and chemical reactions were subsequently induced by electron impact. A wide range of cationic and anionic salt clusters were produced, with $(\text{NaF})_n\text{Na}^+$ and $(\text{NaF})_n\text{F}^-$ among the main species. Consistent with previous studies in the gas phase, mass spectrometry analysis showed that energetically favourable structures are obtained for 'magic numbers' including $n = 7, 22$ and 37 , which coincide with complete unit cells of the face-centred-cubic lattice. Other abundant species that incorporated sulfur were also observed, such as $(\text{NaF})_n(\text{Na}_2\text{S})_m\text{Na}^+$ and $(\text{NaF})_n\text{S}^-$.

The researchers propose that clusters of sodium and clusters of SF_6 are both first embedded within a droplet and only react when energy is provided through electron impact. The self-assembly of cationic clusters is thought to be initiated through two mechanisms: collision of a dopant with metastable excited helium atoms (He^*) or charge transfer from molecular helium cations (He^+) that form on electron impact. The formation of the anionic clusters occurs through electron transfer from a more exotic species — a metastable excited helium anion (He^-) that has only recently been recognized as produced by electron impact on liquid helium droplets. AP

Written by Gavin Armstrong, Enda Bergin, Claire Hansell and Anne Pichon.

Correction

In the Research Highlight 'Molecular materials: Persistent porosity' (*Nature Chem.* **6**, 1028; 2014), the penultimate sentence of the second paragraph should have read: 'Those sheets are in turn held together through interlayer π - π stacking interactions between the electron-rich pyrazole units and the comparatively electron-poor fluorinated aromatic rings'. This has been corrected in the online versions after print 25 November 2014.

blogroll

Friends and foes

Battling pseudoscience and chemophobia with knowledge and education.

When there are concerns about chemicals and the foods we eat, chemophobia usually runs rampant. More information about what we eat is a good thing. Pushing an agenda using pseudoscience, dubious sources and a fear of chemicals is not. Fortunately, analytical chemist Yvette Guinevere, writing as Science Babe, has taken it upon herself to address a popular series of unscientific food claims by "using science to rip them to shreds" (<http://go.nature.com/vX9X55>).

A more sensible way of looking at the chemicals in the foods that we eat would be to learn from those who actually understand and practice the science behind them. We call these people scientists, and a group of them from UCLA have banded together to write the blog Science & Food. Topics range from how proteins denature to achieve the perfect soft-boiled egg (<http://go.nature.com/sOAik4>), to the chemicals and mechanisms responsible for the flavours of fresh, cooked and dried ginger (<http://go.nature.com/mb7Nst>).

Science isn't all rainbows and unicorns, however, and any complete education should include the deleterious effects that may arise from ingesting certain chemicals. ForensicToxGuy — unsurprisingly a forensic toxicologist — blogs at The Dose Makes the Poison and tackles the chemistry and toxicology surrounding the newest waves of designer drugs. Of particular interest to him are synthetic cannabinoids, which thanks to their 'alphabet-soup' nomenclature, confound doctors, scientists and legislatures alike (<http://go.nature.com/YgQdxj>). If you've ever wondered what ADB-CHMINACA is, here's your chance to find out.

Both friends and foes, chemicals simply exist. Everywhere. But discerning between the good and the bad requires education by those skilled in the field, and these blogs are not a bad place to start.

Written by Justin Brower, who blogs at <http://naturespoisons.com/>