

its low redox potential limits the efficiency of DSCs. Cobalt-based mediators have been suggested as possible replacements, but they also cause poor device efficiency because of their propensity to combine with previously photogenerated electrons on the titania surface. Now, Aswani Yella from EPFL in Switzerland and co-workers have developed a dye molecule that slows down this recombination process allowing the efficient use of a cobalt-based mediator.

Yella and co-workers used a cobalt(II/III) tris(bipyridyl) tetracyanoborate complex as the mediator and a zinc porphyrin dye. The dye has a donor- $\pi$ -acceptor structure, with a diarylamine donor, a porphyrin  $\pi$ -bridge and a titania-anchoring ethynylbenzoic acid group. Attached to the porphyrin ring are long alkoxy chains, which are thought to block the cobalt mediator's access to the titania surface, thus reducing the rate of recombination. The set-up described generated high voltages of around 1 V and with an efficiency of 11.9%. GA

#### HYDROGEN STORAGE

### A liquid solution

*J. Am. Chem. Soc.* **133**, 19326–19329 (2011)

Hydrogen is desirable as a fuel because it would release only water into the environment and could potentially be produced cleanly by photocatalytic water splitting. It is, however, fairly difficult to use as a fuel, especially for transportation, because of its explosive nature and low energy density. These two problems are amply demonstrated by the current best storage solution, tanks of compressed hydrogen gas, which is understandably not an ideal solution for everyday motorists. Current work investigating solid materials in which to store hydrogen suggest that they fall far short of the energy densities required.

There are several potential liquids also under consideration as storage media, but these have a variety of drawbacks, including stability, recyclability and unwanted phase changes. Now, Shih-Yuan Liu and colleagues from the University of Oregon report a small cyclic amine borane molecule that solves many of these problems. It can be dehydrogenated to form a trimer using an inexpensive  $\text{FeCl}_2$  catalyst. This reaction, which needs heating to only 80 °C (compared with 200 °C for some reported systems), releases two molecules of hydrogen per amine borane molecule.

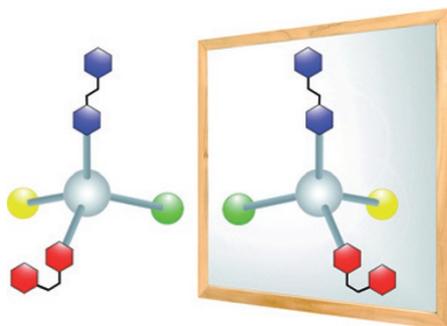
Both the amine borane and the dehydrogenated trimer remain liquid over the required temperature range, removing problems such as solidification or contamination of the gaseous hydrogen

output through evaporation. Although the regeneration procedure is not fully optimized, it does proceed at room temperature using fairly routine and cheap reagents. NW

#### STEREOCHEMISTRY

### A photo finish

*Angew. Chem. Int. Ed.* **50**, 11729–11730 (2011)



An object that cannot be superimposed on its mirror image is said to be chiral. This condition is satisfied for organic molecules in which one of the carbon atoms is bonded to four different groups. This 'point chirality' is typically a static feature: the arrangement of the four substituents around a central carbon atom is fixed when the molecules are made, and does not change unless bonds are broken and reformed.

Now, Nobuyuki Tamaoki and P. K. Hashim from Hokkaido University have designed and made an achiral molecule in which they can induce point chirality by exposing it to ultraviolet light. The compound contains a carbon atom bonded to a methyl group, a phenyl group and two azobenzene groups. Each azobenzene substituent can exist in either a *cis* (*Z*) or *trans* (*E*) configuration and can be switched reversibly between each form using light or heat. Both azobenzene groups adopt the same *E* configuration in the ground state and, because two of the four substituents are identical, the compound is achiral. When exposed to ultraviolet light, some of the azobenzene groups isomerize from *E* to *Z* and a mixture of compounds is formed, including the *EE*, *EZ* and *ZZ* isomers.

Both the *EE* and *ZZ* isomers are achiral, but the *EZ* compound is chiral. The point chirality comes from the two azobenzene groups adopting different configurations (hence four different groups around a central carbon atom) and both the *EZ* and *ZE* enantiomers are formed. SC

Written by Gavin Armstrong, Stuart Cantrill, Stephen Davey, Anne Pichon and Neil Withers.

## blogroll

### A hot topic

Looking closely at pepper spray and an explosive mouthful.

People may think that blogs — even those about chemistry — only cover what the blogger had for breakfast and the occasional picture of cute kittens. Hopefully this column has dispelled some of those thoughts in the past few years, but if anyone still needs persuading, Deborah Blum's post About Pepper Spray (<http://go.nature.com/iV1eQb>) should do the trick. Written shortly after a "shocking incident involving peacefully protesting students at the University of California-Davis", Blum took her readers through the chemistry behind the innocuously named weapon. For those familiar with the Scoville scale, pepper spray is about 1,000 times hotter than jalapeños and up to 25 times hotter than habaneros. But if you think that the effect is similar to the stinging eyes you may have experienced after not being careful in the kitchen, Blum warns "we're not talking about cookery but a potent blast of chemistry". Capsaicins, the compounds that confer heat on both chillies and pepper spray, "inflammate the airways, causing swelling and restriction" making it particularly dangerous "to people with asthma and other respiratory conditions". So dangerous, in fact, that it has been linked to around 75 deaths.

Blum's post about such a newsworthy topic gathered so much attention it's been re-posted in many venues, including *Scientific American* where it was the most popular item on the site for days. She even appeared on the Rachel Maddow show on MSNBC to discuss pepper spray (the segment can be found via <http://www.msnbc.msn.com/id/26315908/>).

On a less controversial, although slightly more explosive, topic, Derek Lowe treated us to another thing he won't work with, hexanitrohexaazaisowurtzitanene. Hiding behind that mouthful are six nitrogen atoms, each bonded to one of six nitro groups. If you dare to even imagine making it, Lowe suggests that you "picture a bunch of guys wheeling around drums of fuming nitric acid while singing the Anvil Chorus from *Il Trovatore*".