

immobilized thin-films and be able to control their patterning. Approaches to gain such spatial control are still in their infancy, but include layer-by-layer deposition and lithographic methods. Layer-by-layer deposition is a multistep process, and many lithographic approaches start with the deposition of a homogeneous MOF layer followed by selective etching — also a time-consuming, multistep process.

Now, a team from the University of California, Berkeley led by Rob Ameloot have developed an alternative method for forming patterned MOF films in a single step. Because MOF formation often occurs on the deprotonation of organic ligands — which enables them to complex with metal ions — their strategy relies on the use of a compound that generates a base on irradiation. On sandwiching the synthesis mixture between glass plates and overlaying a photomask, UV light is applied and selective MOF formation occurs only where the base is generated. The team also applied the technique sequentially, with an interim washing step, to deposit two different MOFs in different areas of a single film.

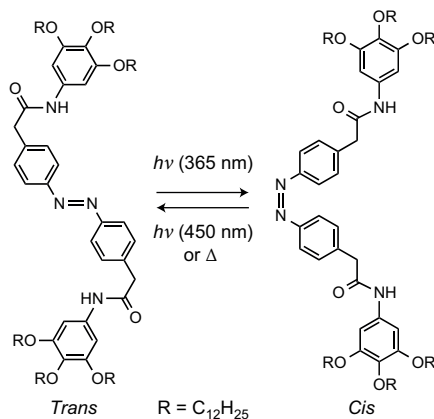
Three different MOFs were patterned using the technique, and because many MOFs rely on deprotonation of the ligand for their synthesis, this suggests that it could be applied to make other patterned MOF films too. However, the photobase generator is free to diffuse through the solution during irradiation (which takes approximately 15 minutes), therefore pattern resolution is restricted to the micrometre scale, rather than the tens of nanometres that can be achieved by using photolithography in the manufacture of microelectronics. Future developments to improve the resolution of the patterns may focus on reducing the irradiation time required for MOF film formation; however, this limitation does not preclude using these films for sensing applications. CH

#### SELF-ASSEMBLY

### Sound and vision

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Light-induced reactions on the molecular scale, such as the photoisomerization of azobenzene between its *cis* and *trans* configurations, are often used to induce macroscopic material changes such as self-assembly, flexing or other motions. Although light is a commonly used stimulus for effecting supramolecular self-assemblies, it is more unusual for audible sounds to elicit any changes in structure, but macromolecules have been observed to respond to sound waves through local



effects on the surrounding solvent, which can combine and be amplified along the molecular chain.

Now, a collaborative team from Kobe University, Kansai University and the Kyoto Institute of Technology, led by Akihiko Tsuda, has shown that the assembly of supramolecular fibres can be induced by light, and mutual alignment of the fibres induced by audible sound. They synthesized a linear molecule with a central azobenzene moiety and three alkyl ‘tails’ at each end that each featured 12 carbon atoms. With the azobenzene in its *trans* form, this molecule was found to stack to form double-stranded supramolecular nanofibres. On UV irradiation to convert to the *cis* azobenzene, amorphous aggregates were instead formed. The aggregation behaviour was found to be strongly dependent on the length of the alkyl tails, with only a 12-carbon chain producing ordered aggregates from the *trans* molecule, and 6- and 16-carbon chains aggregating amorphously in both azobenzene conformations.

Linear dichroism was used to assess whether the supramolecular assemblies were preferentially oriented in solution. Neither the *cis* nor *trans* assemblies showed any anisotropy in their orientation. However, when audible sound waves were applied to the solution, the nanofibres were found to align with each other; no change was observed in the amorphous *cis* aggregates. The degree of ordering was found to vary with the frequency of sound waves, with lower frequencies eliciting a larger response. Both visible light and sound were required to induce the assembly and subsequent ordering of the fibres, akin to a stimulus-AND logic gate. The relative ease of application of both sound and light opens up interesting possibilities for multistimuli responsive materials in the future. CH

Written by Claire Hansell, James Hennessy and Russell Johnson.

blogroll

## Real chemistry

### What does it take to be a real scientist?

We read about the end results and look at the pretty graphs. But what was it actually like in the lab? The journey behind the data is often lost and the formal tone of a journal article cannot come close to conveying the love, suffering and fun that went into producing those results. However, bloggers and Twitter users are gradually breaking down that barrier and revealing a behind-the-scenes view of real chemistry.

A very open and engaging story of the work behind a *Nature Materials* article was blogged by Sylvain Deville. ‘The Making of a Paper’ (<http://go.nature.com/VmLUG1>) takes us from the initial grant proposal, to the excitement of preliminary results and the pain of getting scooped. The Baran Lab also shares the stories behind their publications. Honestly stating “we had no idea we’d turn to electrochemistry” (<http://go.nature.com/RnVxHa>) shows the success of an unexpected direction.

Elsewhere, the @RealScientists rotation-curation Twitter account continues to regale us with the daily activities of different scientists. Someone new is brought in each week to run the feed and showcase their own small slice of science. Previous curators include analytical (<http://go.nature.com/vYabRK>) and physical (<http://go.nature.com/INuwBf>) chemists and, at the time of writing, an evolutionary biologist has been delighting us all with the wonders of sex chromosomes (<http://go.nature.com/8AwMle>).

It’s impossible to mention real science without talking about the Twitter phenomenon that is #RealTimeChem. This banner brings together chemists from all over the world and its creator, Dr Jay, is organizing the second annual RealTimeChem week (<http://go.nature.com/rkIETM>). Your fellow chemists will be sharing more of their experiences and lab frivolity through blogs and tweets, and everyone can join in.

Written by Tom Branson, who blogs at <http://chemicallycultured.blogspot.com>