

of thioflavin T into the supramolecular capsules mimics its biological confinement inside fibrils.

The significance of the study lies in the distinct responses of the two different capsules to a physiologically relevant stimulus (metal ions), potentially allowing the controlled release of a drug, the uptake of a metabolite or even the removal of a toxin by using capsules of variable stoichiometries.

Furthermore, cucurbiturils stand out with respect to their exceptionally high guest-binding constants, which offer a large dynamic range for competitive displacement of loaded guests^{6,9}. Here, thioflavin T can be released even from the most compact capsule — the metal-reinforced 2:1 complex — by addition of an even stronger competitor, the 1-ammonium adamantane ion. This ion shows an extremely large binding constant that is more than one million times that of thioflavin T, and consequently displaces almost any guest

from cucurbit[7]uril. Interestingly, this strong competitor exists on the market as 'amantadine hydrochloride' and is used as an anti-Parkinson and antiviral drug¹⁰, which underlines how close to practical applications the introduced strategy could prove to be.

From a more conceptual and fundamental viewpoint, the study illustrates that these interactions between metal ions and cucurbituril host-guest complexes hold promise for various interesting applications. For example, one could imagine replacing the inert metal ions used in the present study by transition metal ions with redox activity or catalytic properties. This could readily convert the described supramolecular capsules into nanoreactors or metalloenzyme models. Metalloenzyme models have been described by covalently linking metal-binding ligands to macrocycles such as cyclodextrins or calixarenes, but the potential to self-assemble such reactive

centres at the cucurbituril rim is certainly an exciting prospect. □

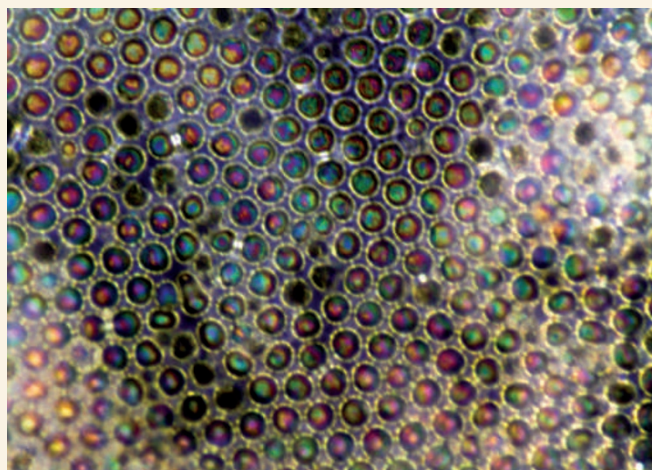
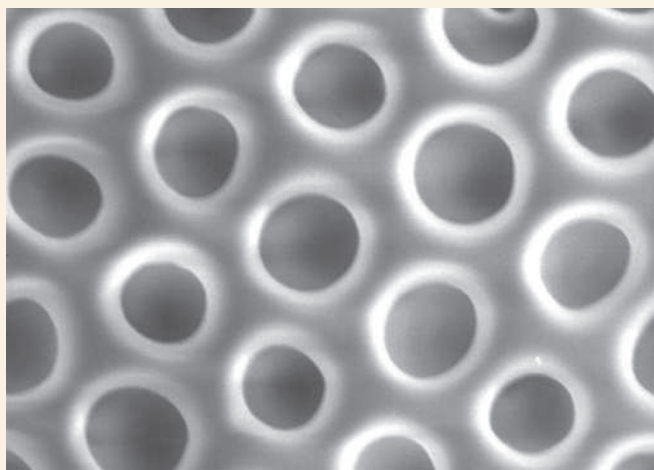
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References

1. Choudhury, S. D., Mohanty, J., Pal, H. & Bhasikuttan, A. C. *J. Am. Chem. Soc.* **132**, 1395–1401 (2010).
2. Behrend, R., Meyer, E. & Rusche, F. *Liebigs Ann. Chem.* **339**, 1–37 (1905).
3. Freeman, W. A., Mock, W. L. & Shih, N. Y. *J. Am. Chem. Soc.* **103**, 7367–7368 (1981).
4. Kim, J. et al. *J. Am. Chem. Soc.* **122**, 540–541 (2000).
5. Day, A., Arnold A. P., Blanch, R. J. & Snushall, B. J. *Org. Chem.* **66**, 8094–8100 (2001).
6. Lagona, J., Mukhopadhyay, P., Chakrabarti, S. & Isaacs, L. *Angew. Chem. Int. Ed.* **44**, 4844–4870 (2005).
7. Uzunova, V. D., Cullinane, C., Brix, K., Nau, W. M. & Day, A. I. *Org. Biomol. Chem.* doi:10.1039/b925555a (2010).
8. Campioni, S. et al. *Nature Chem. Biol.* **6**, 140–147 (2010).
9. Rekharsky, M. V. et al. *Proc. Natl Acad. Sci. USA* **104**, 20737–20742 (2007).
10. Rajput, A. *Nature Rev. Neurol.* **2**, 648–649 (2006).

POROUS FILMS

Practical honeycombs



Thin films with a honeycomb structure can be prepared using the so-called breath figure technique, whereby water — condensed on the surface of a polymer solution and arranged in a hexagonal array — acts as a template around which the film forms. Such films are particularly attractive because their thickness, surface area and pore dimensions are controllable. Now, Koh Hou Wong and co-workers at the University of New South Wales in Sydney have adapted the technique to make films with improved mechanical properties (*Chem. Mater.* **22**, 1878–1891; 2010).

Two highly branched silicone-based copolymers were first prepared by free-radical polymerization — a process that is cheap, easily scalable and enables good control over the structures formed. The co-polymers were then assembled into a honeycomb-structured porous film through the breath-figure technique. Alkoxysilane functional groups were subsequently crosslinked by the sol-gel process to give highly porous, stable and flexible films (pictured, left).

The researchers studied the thermal conductivity of the film by seeding a thermosensitive polymer inside its pores

and observing its phase transition on changing the temperature. The thermosensitive polymers occupying the pores reflect a range of visible-light wavelengths and appear multicoloured, whereas the porous film appears translucent (pictured, right). On heating, the phase transition of the seeded polymer can therefore be directly observed.

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