

ed fluorophosphates glass composition possess a better thermal stability which can achieve a larger working range during optical fiber drawing. Investigation of the doped glass IR transmission spectrum shows that the transmittance of the glass in the infrared is as high as 90% and that the absorption around 3 μm , related to the OH^- absorption band, is negligible. Finally the infrared

photoluminescence studies show a strong 2.7 μm emission band for the codoped $\text{Er}^{3+}/\text{Pr}^{3+}$ glass, which is not present for the only Er-doped glass. Analysis of the upconversion spectra in the green visible range shows that this behavior is due to an energy transfer process in which the presence of Pr ions participate, and as a result the 1.55 μm Er emission is weakened while the 2.7 μm emission is

enhanced. Furthermore, peak of calculated emission cross-section in $\text{Er}^{3+}/\text{Pr}^{3+}$ doped fluorophosphates glass at 2708 nm achieves $(6.57 \pm 0.11) \times 10^{-21} \text{ cm}^2$ which is higher than the result of Er^{3+} doped oxyfluoride transparent glass ceramics ($4.3 \times 10^{-21} \text{ cm}^2$) and ZBLAN glass ($5.7 \times 10^{-21} \text{ cm}^2$).

Rosalía Serna

Nano Focus

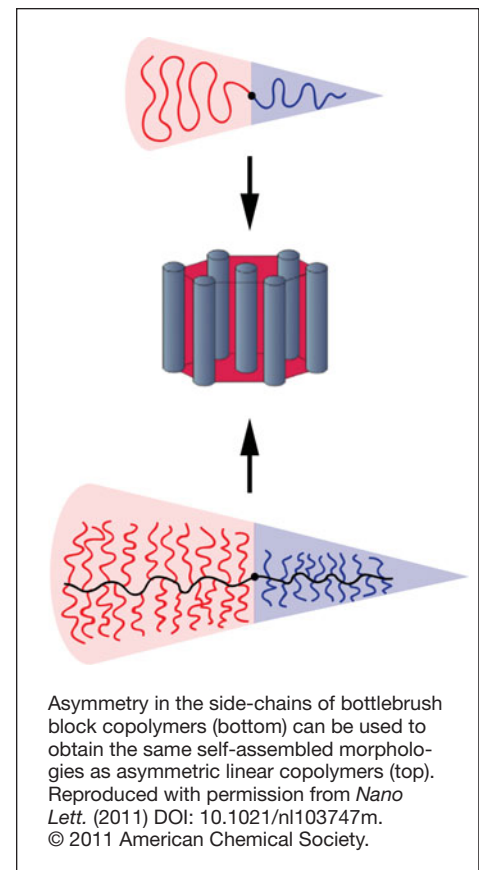
Bottlebrush copolymers expand size range of nanopores

The wide variety of nanostructured morphologies derived from the self-assembly of block copolymers provides a useful route to nanoporous materials. Degrading one of the polymer blocks leaves a porous network of the remaining polymer, which can be used for filtration and selective crystallization. Their main limitation is the small pore sizes currently accessible, but recent research by J. Rzyev and J. Bolton at the University at Buffalo and T.S. Bailey of Colorado State University shows that this range can be significantly extended by the use of so-called “bottlebrush” copolymers, in which polymer side-chains fan out from a central backbone.

The morphology of self-assembled block copolymer materials is normally controlled by altering the length ratio of the two blocks, giving rise to segregated regions in the form of flat planes, cylinders, or spheres. Bottlebrush copolymers, which can have polymer side-chains of different lengths, offer another variable with which to alter the space taken up by each block and thus the morphology they adopt. The research, published in

the January 31st online edition of *Nano Letters* (DOI: 10.1021/nl103747m), uses asymmetrical bottlebrush polymers consisting of a block with long polystyrene side-chains and one with shorter polyactide side-chains. Using a combination of controlled radical and ring-opening polymerizations, the team synthesized a methacrylate-based block copolymer and then grew the side-chains sequentially from this backbone. Melt pressing and annealing the polymer results in randomly oriented polyactide cylinder domains, which were aligned by channel die processing. Degrading the polyactide chains in alkaline conditions leaves a polystyrene material with nanoscale channels ($55 \pm 16 \text{ nm}$) running the width of the sample. This represents a substantial increase in size over pores derived from ordinary block copolymers (up to 35 nm), and it is likely that a much greater range is accessible by appropriate tailoring of the side-chains.

A potentially useful side effect of fabricating the material in this way is that the polymethacrylate backbone remains intact and present within the pores. The most striking consequence of this is that despite the material being principally polystyrene, the pores are hydrophilic and can uptake water. These leftover



backbones could also provide a useful scaffold for chemically modifying the pores in a host of ways.

Tobias Lockwood

Energy Focus

Light-trapping Si PVs obtained by UV-nanoimprint lithography

Light-trapping is necessary to achieve low-cost and high-efficiency thin-film Si photovoltaics devices. Many

nano-architectures leading to light scattering have greatly improved efficiencies although their ideal characteristics remain uncertain. C. Battaglia and co-workers from the École Polytechnique Fédérale de Lausanne recently used UV-nanoimprint lithography to fabricate

12% efficiency micromorph (a-Si :H/ $\mu\text{-Si}$:H) tandem cells with identically nanostructured ZnO and In_2O_3 :H front electrodes.

As described in the February 9th issue of *Nano Letters* (DOI: 10.1021/nl1037787; p. 661), the researchers used