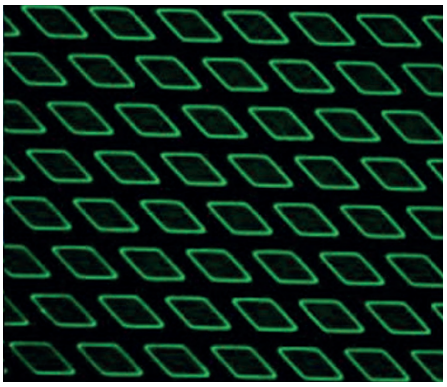
ORGANIC SEMICONDUCTORS

Fast crystal patterning

Adv. Mater. http://doi.org/f3gkw8 (2015)



WILEY

Semiconductor small molecules aligned into defect-free single crystals have shown improved optoelectronic performance. Several approaches have been developed to control molecular assembly on large areas, yet fast fabrication of arrays of single crystals with customized geometry, a key step for the use of organic semiconductors in large-scale integrated circuits, is still challenging. Wei Deng and colleagues now show that spin-coating of fast-evaporating solutions of 9,10-bis(phenylethynyl)anthracene and other molecules on pre-patterned wafers is an effective way to realize arrays of crystalline organic nanowires within one minute. The deposited solution fills the gaps between the photoresist patterns realized on the substrate and then rapidly exits due to both evaporation and centrifugal force. However, it remains partially pinned at the edges of the patterns, where the molecules nucleate and self-assemble into crystalline nanowires. This method is used to realize complex patterns of organic crystals with arbitrary shapes, as well as parallel nanowire arrays working as high-mobility conducting channels in flexible organic field-effect transistors. *LM*

NANOMEDICINE

Polymeric vaccines

Nature Biotechnol. http://doi.org/8z3 (2015)

There are a number of design considerations when developing nanoparticle-based vaccines with optimal immunogenicity. Previous studies have shown how the effectiveness of a protein or peptide antigen can be enhanced through co-administration of an appropriate adjuvant. Geoffrey Lynn and colleagues now present a systematic study of how the physicochemical properties of polymer-linked adjuvants can dictate their *in vivo* pharmacokinetic profiles. They firstly generated a combinatorial library of chemically distinct polymers bearing Toll-like receptor agonist adjuvants in varying densities. They found that those polymers that were more susceptible to aggregation displayed significantly improved biodistributions and immune responses following *in vivo* administration. Taking advantage of these findings, they then succeeded in developing a stimuli-sensitive polymer, bearing these same adjuvants as well as antigenic peptides, which aggregates into an active immunogenic nanoparticle at physiological temperatures. These findings serve to demonstrate how the judicious selection of a polymeric carrier can significantly enhance the efficacy of antigen/adjuvant combination vaccines. *JH*

COLLOIDAL QUANTUM DOTS

Long-lived lasing

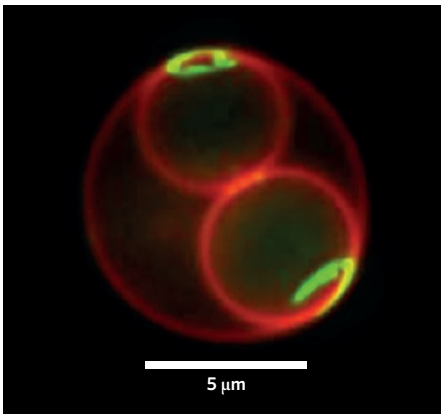
Nature Commun. **6**, 8694 (2015)

Colloidal quantum dots have attracted a lot of attention as prototype light emitting devices, not only due to their high quantum yield but also the ease of controlling their emission properties. Lasing from colloidal quantum dot films has already been reported, limited to nanoseconds. Ted Sargent and collaborators now report lasing, sustained for microseconds. Contrary to previous reports that linked poor lasing behaviour to Auger recombination, the team focused on the role of heating of the samples. The researchers studied very thin films of CdSe–CdS–ZnS core–shell–shell dots, integrated with highly conductive substrates and succeeded in observing lasing on a microsecond timescale. Their findings underline the role of poor thermal management on the quest for lasing, coming from heating from the pump source. The authors believe that a further decrease in the lasing threshold, combined with a highly thermally conductive substrate that also supports low-loss optical propagation, will allow for the observation of continuous-wave lasing. *MM*

TRANSMEMBRANE PROTEINS

Sorted by curvature

Nature Commun. **6**, 8728 (2015)



NPG

When proteins that span the width of a cell's lipid membrane distort the membrane's shape, the proteins tend to aggregate in regions where membrane curvature helps to minimize such distortion. Such a curvature-driven mechanism of the localization of transmembrane proteins has been observed *in vitro*. However, experiments *in vivo* have supported an alternative model, where the clustering of the proteins is driven by stochastic nucleation. Now, H. Strahl *et al.* show that in the long-studied rod-shaped bacterium *Bacillus subtilis*, bacterial chemoreceptors (which in this case are protein complexes made of trimers of dimers that act as sensory clusters) accumulate at the highly curved membrane areas that are generated during cell division. The researchers find that it is indeed the curvature mismatch between the chemoreceptor trimers and the membrane (rather than stochastic clustering of the proteins) that is responsible for the aggregation of the protein complexes in highly curved membrane regions. *PP*

GRAPHENE SYNTHESIS

Molten bed

Adv. Mater. http://doi.org/f3jqnc (2015)

A critical challenge in realizing the applications potential held by graphene is the ability to synthesize large-area and high-quality sheets. Chemical vapour deposition is an attractive approach for this, and relies on the use of a typically crystalline metallic substrate. Zhongfan Liu and co-workers now take a different approach. They grow high-quality graphene disks on molten soda-lime-silica glass, achieving rapid nucleation and growth rates due to energy input from the thermally-softened substrate. A particular advantage of the glassy substrate is that its isotropic nature means that graphene nucleation is not favoured at specific sites. Instead, graphene disks nucleate homogeneously and converge to form a continuous film. The authors additionally demonstrate that their 'glassy graphene' could find use in smart heating devices. Such a synthesis strategy is ironically similar to that used for the production of soda-lime-silica glass for windows, in which it floats on a bed of molten tin, to achieve a smooth surface finish. *JP*

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