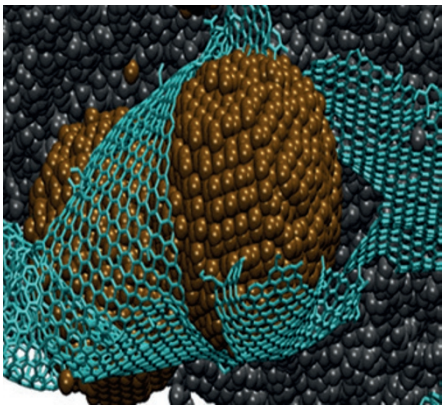
FRICTION

Sliding scrolls

Science **348,** 1118–1122 (2015)



AAAS

Superlubricity — the condition by which friction between two surfaces essentially tends to zero — has been previously observed for nanoscale sliding structures. Realizing it at the macroscale however is highly desirable for engineering applications, yet problematic due to issues with structural defects. Towards this end, a number of works have proven the beneficial effect that graphene can play in reducing friction. Now, Diana Berman *et al.* have demonstrated that superlubricity can be achieved at the macroscale in a dry environment by the addition of nanodiamonds between graphene flakes on a silicon substrate and a sliding diamond-like carbon interface, reporting a coefficient of friction of approximately 0.004. Analysis of the wear debris reveals that the nanodiamonds become wrapped up in the graphene flakes, forming nanoscrolls. Supporting simulations show that more of the graphene flakes scroll with time, gradually reducing the contact area between the nanoscrolls and the diamond-like carbon contact surface, allowing a superlubric state to be reached. *JP*

DNA NANOSTRUCTURES

Stable chainmail

Angew. Chem. Int. Ed. http://doi.org/f272jw (2015)

DNA nanotechnology, which relies on the programmability of complementary base pairing, has shown that it is possible to fabricate a wide range of increasingly complex DNA-based nanostructures for a growing range of potential applications. However, the inherent sensitivity of DNA to environmental conditions (such as extremes of pH, high temperature or low ion content, as well as the presence of deoxyribonucleases) imposes some practical limitations, particularly in biological applications. In an attempt to address some of the restrictions, Antonio Manetto and colleagues have engineered an extended DNA-catenane structure designed to be more stable. The researchers assembled a six-helix bundle of 24 oligonucleotide tiles, some of them modified with azide and alkyne groups at their termini. By spatially organizing the modified sequences, interlocked strands can form through a simple one-step click-reaction. An extension of the procedure to all 24 oligonucleotide tiles leads to a covalently linked interconnected network that is stable at high temperatures and low ion content, and to enzyme degradation. *JH*

POLYMER SUBSTRATES

Supporting pluripotency

Adv. Mater. http://doi.org/f275ds (2015)

Billions of human pluripotent stem cells will be needed for interventions in regenerative medicine, and also for the screening of pharmaceuticals. A promising way to produce large numbers of stem cells is the use of synthetic, chemically defined polymeric substrates able to offer high cell-growth rates. Yet finding polymers that support the clonal growth of human embryonic stem cells is limited by scaling-up and protein-preconditioning limitations. Now, by using high-throughput screening of polymer microarrays (with over 900 unique polymers), Morgan Alexander and colleagues have found a synthetic copolymer substrate that supports the attachment, pluripotency and expansion of human pluripotent stem cells as well as their direct differentiation into cardiomyocytes, hepatocyte-like cells, and neural progenitors, in commercial media and without the need for protein preconditioning (which is expensive). Also, the researchers identified two key integrins involved in the attachment of the stem cells to the polymer substrate. *PP*

ORGANIC TRANSISTORS

Holey contacts

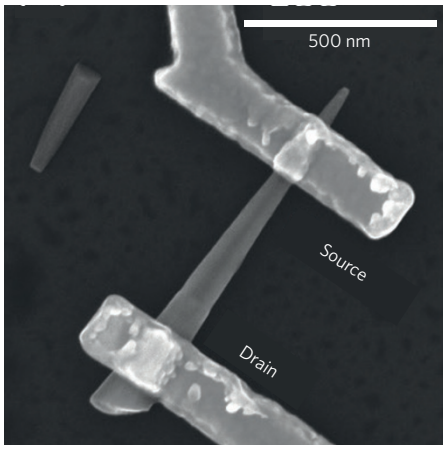
Adv. Functional Mater. http://doi.org/f272xv (2015)

The morphology of the conducting channel strongly affects the performance of organic transistors based on small molecules. Recently, it was observed that pentacene thin films evaporated on holey insulators show a porous morphology that decreases the formation of grain boundaries in the film and leads to improved charge transport. Deyang Ji and colleagues now report that an analogous strategy is effective in reducing the contact resistance and enhancing charge carrier injection from the contacts of the transistor to the conducting channel. Gold pads having holes with diameters ranging from 300 to 500 nm were realized by nanosphere lithography on a silicon substrate, and pentacene molecules were vacuum-deposited on top of this device after plasma treatment. The holes induce a nanoporous texture in the organic film grown on the gold contacts and increase the size of the pentacene grains forming the conducting channel. Such improved morphology leads to an enhancement of the charge carrier mobility and output current of the transistors. *LM*

SEMICONDUCTOR NANOWIRES

Sn-seeded Esaki diode

Nano Lett. http://doi.org/43t (2015)



AMERICAN CHEMICAL SOCIETY

Metal seed particles have been regularly used in the fabrication of semiconductor nanowires, as they provide a means to control the nanowire properties, such as growth rate and geometry. However, the incompatibility of materials commonly used (such as Au), with conventional processing techniques, and the need for control over desirable doping profiles of the nanowires, have led to the investigation of alternative materials. Kimberly Dick and colleagues now explore the potential of Sn as a seed particle for GaAs nanowires, grown by metal–organic vapour phase epitaxy. The nanowires are found to be free of stacking defects, while behaving similarly to highly doped p–n junctions (Esaki diodes). The doping is likely to be due to the incorporation of Sn in the core of the nanowire. Achieving such characteristics during a single-step growth process, without additional doping is rather unexpected. This work highlights the potential of alternative elements as metal seed particles for the fabrication of nanowires with new material properties. *MM*

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