A good stretch

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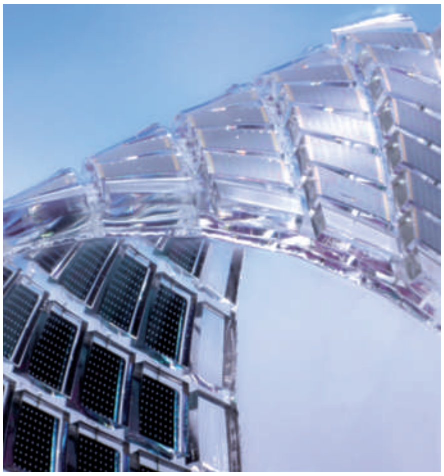

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New photovoltaic devices play an increasingly large role as an energy source for applications that don't necessarily centre on large-scale solar-cell facilities. In particular, stretchable and flexible solar cells could open up entirely new applications involving curved surfaces. However, the various device concepts studied so far have drawbacks of their own. The most stretchable design is based on rigid pieces of semiconductor solar cells that are separated by stretchable electrical connectors. John Rogers and colleagues have now investigated which design of these interconnects enables the largest solar-cell areal coverage while still maintaining sufficient stretchability. They conclude that interconnects buried in narrow grooves between the light-absorbing GaAs semiconductor pieces are best to reduce stresses from bending while taking up a minimum of space. Their semiconductor devices are square islands of 800 μm length, separated by extendable grooves of an initial width of 156 μm. The entire design of the stretchable solar cells is straightforward to fabricate, and its enhanced areal coverage promises an economically viable implementation.

Strained to stick

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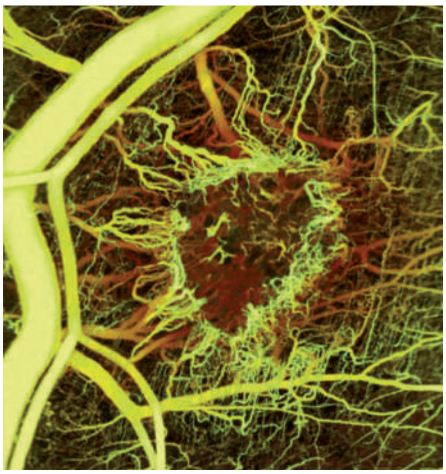
Measurements of the conductance of single molecules explore the interplay between chemical structure and charge transport on the atomic scale, and usually require terminal anchoring groups to establish a stable connection with two metal electrodes. Thiol groups represent the most prominent example of this scheme, but many more routes are being investigated. Severin Schneebeli and colleagues now demonstrate that contact with single molecules can in fact be made without relying on such chemically distinct end groups at all. They find that strained benzene rings in paracyclophanes can bind directly to nanoscale gold electrodes, thus forming a contact that is sufficiently stable to measure the conductance across single molecules at room temperature.
The results, which were obtained in break junction experiments, not only represent a route towards new single-molecule anchoring schemes — they also demonstrate the electronic coupling between π–π-stacked aromatic systems at the single-molecule level, due to, the authors suggest, a large part of the junction current being carried by direct tunnelling between the stacked benzene rings that make up the paracyclophanes.

Diffusion rules in tumours

Proc. Natl. Acad. Sci. **108,** 1799–1803 (2011)



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Nutrients reach cells in tissues by flowing to nearby blood vessels, and are then transported by diffusion and convection to the cells. The vasculature of normal tissue is well spaced and hierarchically branched so that all its cells can be fed, but that of tumours is tortuous and highly disorganized, leaving numerous regions unperfused. Such heterogeneity in the vascular architecture of tumours makes any prediction of the transport and delivery of drugs difficult. Now, Baish *et al.* show that simple scaling rules link vascular structure to extravascular diffusion (the dominating delivery mechanism). They found that two geometric parameters — the maximum distance between a cell and the nearest blood vessel, and a measure of the convexity of the space between vessels, which can be extracted from vascular images — capture the essential differences in diffusion between healthy and tumour tissue at long and short timescales, respectively. The scaling relations unveiled should help in evaluating the efficacy of using treatments that inhibit vascular growth to enhance the delivery of therapeutic drugs.

No need for arsenic

Appl. Phys. Lett. **98,** 042511 (2011)

Just in case the discovery of superconductivity in FeAs-based compounds had not raised enough interest, it was recently shown that appropriately doped Fe_2Se_2 compounds are also superconductors with critical temperatures around 30 K. The race has now begun to examine the properties of these new compounds in detail. Yoshikazu Mizuguchi and colleagues studied the transport properties of single crystals of $K_{0.8}Fe_2Se_2$, and more specifically they measured the resistivity of their samples as a function of temperature and applied magnetic field. The results showed that the upper critical field — above which superconductivity is destroyed — can be higher than 190 tesla. Furthermore, the anisotropy of the transport properties is relatively small. Both these results are important for potential applications, and are particularly promising as these compounds do not present any hazard from arsenic, which is present in most other Fe-based compounds with relatively high critical temperature.

Soft and supple

Angew. Chem. Int. Ed. doi:10.1002/anie.201006464 (2011)

Making robotic devices out of soft materials could be useful in biomedical applications or, more generally, in the handling of fragile objects. George Whitesides and colleagues have now created prototypes of pneumatically driven soft robots made of multilayered elastomeric composite materials, with differing mechanical properties, that are able to grip and manipulate macroscopic objects by changing the materials' curvature. The robotic devices have channels embedded within certain layers and, on the flow of air into the channels, the composite expands in the most compliant sections. Whitesides and colleagues fabricated a gripper device with a starfish-like structure composed of three layers in which the top layer has embedded channels, followed by a passive layer, and then a gripping layer. They also adapted the gripping layer to have a textured surface to allow easier gripping of objects. When the channels in the top layer are pressurized, the arms of the starfish curl down enabling the device to pick up objects, for example, an egg.