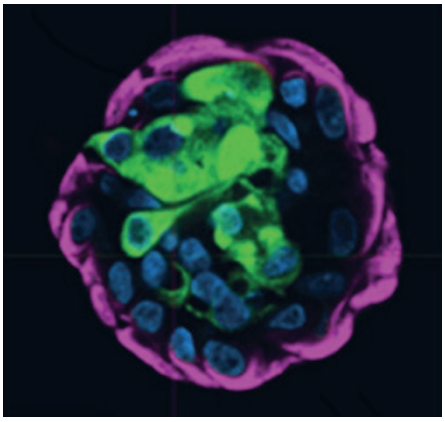
MICROTISSUES

Assembled using DNA glue

Nature Methods **12,** 975–981 (2015)



NATURE PUBLISHING GROUP

When it comes to the reconstitution of the multicellular architecture of 3D tissues, most culture methods provide limited control over long-range tissue organization. 3D-printing and cell-patterning techniques, such as dielectrophoresis and micromoulding, often have low cell viability and resolution, or suffer from limitations in the solvent conditions and type of extracellular-matrix formulations that can be used. Zev Gartner and colleagues now show how cells and template substrates patterned with complementary DNA can be used to program specific and reversible cell adhesion layer by layer to rapidly build organoid-like microtissues with pre-defined size (up to a few centimetres long), shape and composition, and with control over the tissue's 3D structure with single-cell resolution. Using this modular platform, the researchers built microtissues that combined various cell types with high viability to study the effects of spatial heterogeneity, composition of the extracellular matrix, and tissue shape and size on collective cell behaviour. *PP*

CATALYSIS

Pinpointing platinum

Science **350,** 189–192 (2015)

Catalytic metals have been widely applied for the enhancement of important chemical processes. One prominent example is the treatment of exhaust gas to limit carbon monoxide emission, using platinum dispersed on a solid support to catalyse oxidation and water–gas shift reactions. However, the precise nature of the catalytic mechanism, and the potential involvement of either single atoms or nanoparticles of platinum, are still questioned. Now, Kunlun Ding and colleagues present a spectroscopic quantification of platinum atoms and nanoparticles on solid supports and study their respective catalytic contributions. They used infrared spectroscopy to monitor carbon monoxide adsorption on supports with varying platinum contents, and by identifying separate signals for adsorption to either atomic or nanocluster platinum, they were able to accurately quantify these different species. Only the carbon monoxide adsorbed on nanoclusters was observed to participate in the catalytic reaction on exposure to oxygen or water at low temperatures, while single atoms remained unreactive. This provides an important insight for future catalyst optimization. *JH*

SUPERCONDUCTIVITY

Lithium-decorated graphene

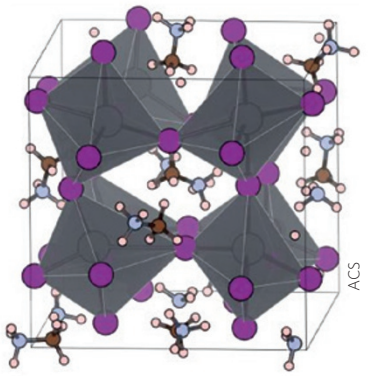
Proc. Natl Acad. Sci. USA **112,** 11795–11799 (2015)

Theoretical works have predicted that decorating graphene with alkali adatoms would induce superconductivity due to the enhancement of the electron–phonon coupling. However, although some studies report experimental evidence for such an enhancement, and superconductivity is well known to arise in graphite with alkali metal atoms intercalated between the layers, its observation at the single-layer level has remained elusive. Now, Bart Ludbrook and colleagues report superconductivity in graphene decorated with lithium atoms. In particular, they observed the formation of a temperature-dependent pairing gap near the Fermi energy by using high-resolution angle-resolved photoemission spectroscopy. These results suggest that the material has a superconducting phase below 5.9 K, which is of the same order as the critical temperatures previously predicted. The next step would be the demonstration of superconductivity through transport measurements, opening up the possible use of graphene in superconducting devices. *DC*

HYBRID PEROVSKITES

Cationic vibrations

J. Phys. Chem. Lett. **6,** 3663–3669 (2015)



ACS

Methylammonium cations play a key role in determining the crystal structure and the photovoltaic behaviour of organic–inorganic perovskite films. The orientation and the dynamics of their permanent dipole moment affect the dielectric response of these materials and may contribute to the hysteretic response observed in perovskite solar cells. Using ultrafast polarization-resolved 2D infrared vibrational spectroscopy, Artem Bakulin and colleagues now study the motion of these organic cations within the inorganic sublattice of methylammonium lead triiodide perovskites synthesized with three different approaches. In all samples, the time-dependent anisotropy of the measured signal reveals two distinct cationic motions on 300-fs and 3-ps timescales. Molecular dynamics simulations are used to assign such contributions to, respectively, wobbling-in-a-cone motion and 90° reorientations of the organic molecules aligned to the main axes of the inorganic lattice. The researchers suggest that such insight may shed light on the contribution of the dielectric behaviour to the photophysical properties of these materials. *LM*

GRAPHENE

Hierarchical fibres

Science **349,** 1083–1087 (2015)

Graphene is known to display an unmatched combination of strength and electrical and thermal properties, making it highly attractive for use in small-scale devices. Achieving such performance in large-scale graphene-based materials is desirable, yet extremely challenging. Jie Lian and colleagues have now demonstrated graphene fibres that exhibit thermal and electrical conductivities of up to 1,290 $W\,m^{-1}\,K^{-1}$ and $2.21\times10^{5}\,S\,m^{-1}$, respectively, and a maximum tensile strength of 1,080 MPa. To achieve this performance, a unique hierarchical structuring approach is adopted, consisting of large-sized graphene oxide sheets intercalated by small-scale graphene oxide sheets. Thermal reduction, followed by annealing, is then used to reduce graphene oxide to graphene, achieving a compact and ordered structure. This study demonstrates how utilizing unique hierarchical structures in artificial materials can yield improved performance. *JP*

Written by David Ciudad, James Hennessy, Luigi Martiradonna, Pep Pàmies and John Plummer.