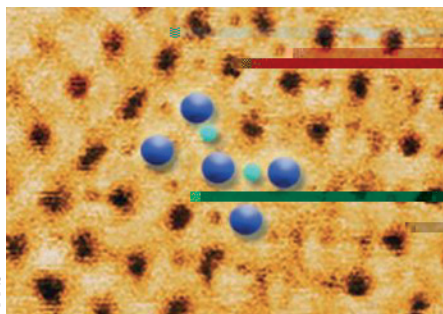


## research highlights

### SOLUTE STRENGTHENING

#### How to pin a screw

Science **347**, 635–639 (2015)



Dislocations are defects in the atomic structure of a material that can move under stress, allowing the material to deform. However, solute atoms can pin dislocations, preventing them from moving and thus strengthening the material. This process is known as solute strengthening. The image shows a micrograph of a material with solute atoms (blue spheres) and dislocations (red lines). The solute atoms are shown to be pinning the dislocations, which is why the material is stronger.

*in situ*

DC

### SUPERCONDUCTIVITY

#### Switched by light

Science **347**, 743–746 (2015)

Superconductivity is a state of matter in which electrical resistance drops to zero and magnetic fields are expelled. This state is typically achieved at very low temperatures. However, researchers have discovered a way to switch superconductivity on and off using light. The image shows a micrograph of a material with a superconducting region (red) and a non-superconducting region (blue). The superconducting region is shown to be switched on and off by light.

L

### OPTICS

#### Flat lenses

Science <http://doi.org/2mn> (2015)

Flat lenses are a type of lens that can focus light without the need for a curved surface. They are made of a material with a flat surface and a refractive index that varies across the surface. The image shows a micrograph of a flat lens (red) and a curved lens (blue). The flat lens is shown to focus light in the same way as a curved lens.

### METAL-ORGANIC FRAMEWORKS

#### Crystals and chains

Angew. Chem. Int. Ed. <http://doi.org/f26btc> (2015)

The processing of metal-organic framework (MOF) powders into specific macroscopic shapes can be achieved by applying mechanical pressure, by using extrusion methods or by the inclusion of additives and binders. Now, Xiao Feng, Bo Wang and colleagues report the formation of elastic, stand-alone membranes of MOF crystalline powders in which polymeric chains covalently join the crystals together. Nanoscale crystals of a MOF — UiO-66-NH<sub>2</sub> — are modified with methacrylamide groups, and then mixed with the monomer butyl methacrylate and a photoinitiator to form a suspension that is dropped into a Teflon mould. Irradiation of the mixture with ultraviolet light induces polymerization resulting in a MOF-polymer hybrid membrane, which is flexible and can be easily peeled away from the mould. The mild conditions of the photopolymerization step allow the MOF nanoparticles to retain their crystallinity producing homogeneous, crack-free membranes that have good abilities to separate heavy-metal ions, such as Cr<sup>VI</sup>, from water. This method could be used for a range of MOF crystals and to prepare many differently shaped hybrid materials.

AS

Written by David Ciudad, Maria Maragkou, Luigi Martiradonna, John Plummer and Alison Stoddart.

MM

### GALLIUM NITRIDE GROWTH

#### A 2D barrier to defects

ACS Appl. Mater. Interfaces **7**, 4504–4510 (2015)



Gallium nitride (GaN) is a wide-bandgap semiconductor material used in light-emitting diodes (LEDs) and power electronics. However, GaN films often contain defects that can reduce their performance. Researchers have discovered a way to grow GaN films with a 2D barrier to defects. The image shows a micrograph of a GaN film (blue) and a substrate (red). The GaN film is shown to have a 2D barrier to defects, which prevents defects from spreading across the film.

LM

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