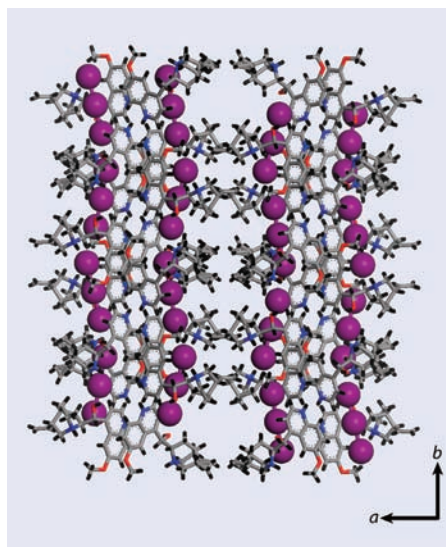


Researchers finally uncover the structure of polaroid

A better understanding of the history of polaroid could lead to breakthroughs in nanotechnology, now that the detailed crystalline structure of the substance has been determined.

Polaroid is made from a crystalline material called herapathite, which was first discovered in 1852 when tincture of iodine was dropped into urine from a dog that had been fed quinine in the laboratory of toxicologist William Bird Herapath. He realized that the resulting crystals made excellent polarizers, however, it was not until the 1920s that Edwin Land, of Polaroid fame, ground the crystalline material into a fine powder and extruded it into polymers to make polarizing filters. Surprisingly, the structure of herapathite has only now been unravelled, thanks to Bart Kahr and colleagues of the University of Washington, Seattle.

Kahr has also discovered that Bernotar, an analogue of polaroid that was made independently by Ferdinand Bernauer (1892–1945) and marketed by Karl Zeiss, seems to be a single crystalline film of herapathite. This is just the kind of material needed for organic electronics these days, but nobody knows how Bernauer did it.



The crystal structure of herapathite. The purple spheres are iodine atoms. The absorbing axis that leads to the polarizing action of the crystals is vertical. Solvent molecules and sulphate ions have been removed for clarity.

Further reading

B Kahr *et al.* 2009 *Science* **324** 1407.
Jyllian Kemsley 2009 *Chemical and Engineering News* **June 22** 43.

Graphene displays an electrically tunable bandgap

The bandgap of a material determines, to a large extent, its electrical and optical properties and this is usually more or less fixed for any particular material. Moreover, some materials have no bandgap, which limits their use in electronics, for instance. Graphene, the 2D crystalline form of carbon, always appeared to be one of these – until now.

Feng Wang of the University of California at Berkeley and colleagues have demonstrated that a gated bilayer of graphene can have its bandgap manipulated electrically over a wide range, from 0 to 250 meV (corresponding to the near infrared). This opens the door to a whole new range of devices for the detection, generation and amplification of infrared light over an interesting frequency region.

Further reading

Y Zhang *et al.* 2009 *Nature* **459** 820.

The subtle science of reproducibility

Scientists usually try to describe their experiments as best they can so that others can reproduce the results, but sometimes small factors that might seem insignificant can make a big difference.

Stephen M Buchwald of MIT in Boston and Carsten Bolm of Aachen University have found that for some organic reactions that are long thought to be catalysed by iron salts, it might be mainly trace impurities of copper at the parts-per-million level that are doing the job. If the iron salt is too pure then the reaction does not work – while forgetting the iron altogether in favour of a trace of copper makes the reaction go well.

Their work serves as an important reminder that to repeat an experiment you may have to repeat everything with great care.

Further reading

Stephen L Buchwald and Carsten Bolm 2009 *Angewandte Chemie International Edition* **48** 5586.

The entropy of language

Archaeologists who find symbols inscribed on ancient objects are often faced with the difficult task of trying to decide if the “writing” corresponds to a language or not – that is, if they are simply a group of symbols rather than a proper piece of text. This was the case recently with a script from the Indus civilization, which existed in what is now eastern Pakistan and north-western India between about 2600 and 1900 BC.

The script has not yet been deciphered, but Rajesh P N Rao of the University of Washington and colleagues found that comparison of the conditional entropy yielded interesting results. The idea is that in a proper language symbols neither follow each other randomly

nor are they always placed in the same order. Comparison of the Indus script places it much closer to natural linguistic systems such as English, Rig-Vedic Sanskrit and Old Tamil – and even programming code Fortran – than to non-linguistic systems such as human DNA or bacterial protein sequences.

So, the script from the Indus civilization appears indeed to be a language, and the fact that the conditional-entropy study places it close to Old Tamil might provide a clue to help decipher it one day.

Further reading

Rajesh P N Rao *et al.* 2009 *Science* **324** 1165.