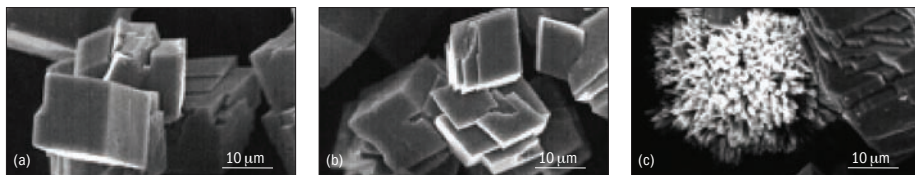


Magnetic fields found to affect aerated water



SEM images of CaCO_3 prepared by mixing CaCl_2 and Na_2CO_3 solutions at 298 K with (a) vacuum-distilled water, no magnetic treatment; (b) vacuum-distilled water with magnetic treatment; (c) magnetic treatment after aeration of vacuum-distilled water.

The more that physicists and chemists look at water, the more they find that it really is pretty mysterious stuff. For example, magnetic fields can change the rate of scale formation in boilers – a process that is not really understood and is somewhat controversial, even though it has found industrial application. Simpler systems would be easier to study and this is just what Ichiro Otsuka and Sumio Ozeki of Shinshu University in Japan have done. They have found that while a magnetic field does not change the physical properties of pure water, it does change the vibrational spectrum and electrolytic potential of water with dissolved oxygen.

The team also found that magnetic treatment of aerated water affected the formation of

calcite (CaCO_3). While magnetic treatment had no effect on CaCO_3 crystal formation when they used vacuum-distilled water, when the water was exposed to air or oxygen (O_2) both X-ray diffraction images and scanning electron microscope (SEM) images of the crystals showed marked differences – indicating in particular the formation of aragonite. The team concludes that only when water dissolves O_2 , not ionic species, is the water magnetized by changing the magnetic flux over the water, but admits that “the phenomena are still puzzling from the viewpoint of modern science”.

Further reading

Ichiro Otsuka and Sumio Ozeki 2006 *J. Phys. Chem. B* **110** 1509.

New perspective on Ohm's law

For the first time it is possible to measure the velocities of electrons (not just the total current) as they flow through a material. Using an electron-spin resonance (ESR) technique in which they put a current-carrying sample in a spatially varying magnetic field, Noam Kaplan of the Hebrew University in Jerusalem and colleagues from Karlsruhe University have managed to track the motion of electrons and measure their speeds.

In fact the team measures the motion-induced phase shift of the ESR signals, in direct analogy to the way that phase-contrast nuclear magnetic-resonance imaging is used to measure blood flow, for example. The new measurements are something of a technical

tour de force since electrons tend to randomize their motion very quickly. To overcome this, the team used a crystal of an organic conductor (fluoranthene) $_2\text{PF}_6$, with electron-spin relaxation times of microseconds, instead of the nanoseconds usual for most materials. This enabled the team to measure the drift velocity of the conduction electrons and so test Ohm's law at a microscopic level. Perhaps not surprisingly, they replicated what would be expected from the well known law, albeit from a rather different point of view.

Further reading

M Drescher, N Kaplan and E Dormann 2006 *Phys. Rev. Lett.* **96** 037601.

UK sets laser record

Juan Diego Ania-Castañón and colleagues at Aston University in the UK have built a laser that is 75 km long. Based on the Raman effect, amplification of a long-wavelength signal is achieved by stimulated emission from atoms pumped by a shorter wavelength. This kind of approach has been tried in the past, but the gain has been very non-uniform, and numerous pump lasers were needed.

The new trick here is to use the Raman effect twice: mirrors at both ends of the laser – in fact 75 km of optical fibre – reflect light at 1455 nm only. Longer than the pump wavelength, but shorter than the signal wavelength, this stimulates Raman emission and makes a very long Raman laser at 1455 nm. This 1455 nm laser then acts as a pump for the amplification (again by the Raman effect) of a signal at 1550 nm, but now with high uniformity.

Further reading

Juan Diego Ania-Castañón *et al.* 2006 *Phys. Rev. Lett.* **96** 023902.

The world's smallest fish starts big debate

There is a new claim for the record for smallest fish in the world. Maurice Kottelat and Tan Heok Hui from the National University of Singapore and colleagues found the little creature in Sumatra. The females grow to just 7.9 mm and the males a little longer. The males are especially interesting as they have a unique set of extra gripping muscles and a fin which seem to help them hang on to the females during mating. The fish also have most of the roof of their skulls missing.

The announcement has provoked other researchers to publicize prior discoveries of tiny fish, sparking a debate on what the words “smallest fish” should actually mean. However, as Kottelat and colleagues point out, “unfortunately, habitat destruction jeopardizes the survival of these fish and thus opportunities for further research”.

Further reading

Maurice Kottelat *et al.* 2005 *Proceedings of the Royal Society B: Biological Sciences*, published online DOI: 10.1098/rspb.2005.3419.

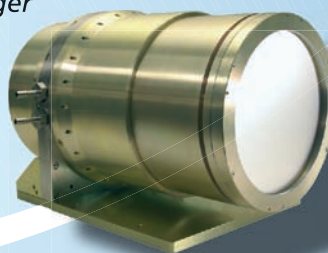
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