Matter & Energy

For longer versions of these and other Matter & Energy stories, visit **www.sciencenews.org**

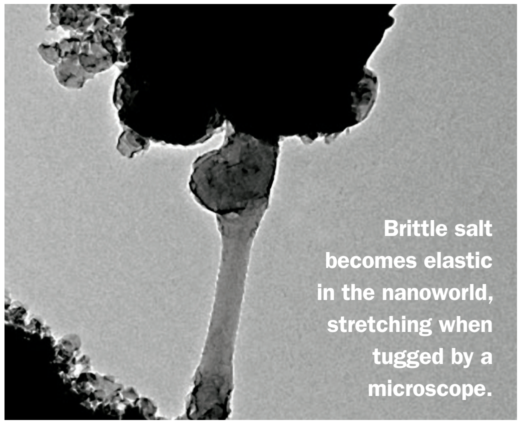
Salt turns to taffy at the nanoscale

Find suggests new technique for making miniature wires

By Rachel Ehrenberg

Inflexible old salt becomes a softy in the nanoworld, stretching like taffy to more than twice its length, researchers report in the June 10 *Nano Letters*. The findings may lead to new approaches for making nanowires that could end up in solar cells or electronic circuits. The work also suggests that these ultra-tiny wires may already exist in sea spray and large underground salt deposits.

Metals such as gold or lead, in which bonding angles are loosey-goosey, can stretch out at temperatures well below their melting points. But scientists don't expect this superplasticity in a rigid, crystalline material like sodium chloride, says study coauthor Nathan Moore of Sandia National Laboratories in Albuquerque.



Brittle salt becomes elastic in the nanoworld, stretching when tugged by a microscope.

This unusual behavior highlights that different forces rule in the nanoworld, says Krzysztof Kempa of Boston College. "Forget about gravity," he says. At this scale, surface tension and electrostatic forces are much more important.

Moore and colleagues guided a microscope that detects various forces toward a chunk of salt. When the microscope's diamond tip was far away, there was no measured force, but within about seven nanometers, a strong attraction developed between the tip and the salt. The salt then stretched out to glom on to the tip.

Using an electron microscope to see what was happening, the researchers observed that "nanowires" had formed.

The initial attraction between the tip and salt might be due to electrostatic forces, the researchers speculate. Several mechanisms might lead to the elasticity, including the excessive role of surface tension in the nanoworld. (The same tension allows a water strider to skim the surface of a pond in the macroworld.)

The surface tension is so strong that as the microscope pulls away from the salt, the salt stretches, Kempa says. "The inside has no choice but to rearrange the atoms, rather than break," he says.

Mass mismatch leads to mystery

Omega-b-minus is detected again, but it's lighter this time

By Jenny Lauren Lee

A heavy, strange cousin of the proton has been seen a second time, but it seems to have lost a little weight.

Omega-b-minus is a three-quark particle related to protons and neutrons. It has been observed at CDF, a detector at the Fermi National Accelerator Laboratory in Batavia, Ill., scientists report online May 19 at arXiv.org. But CDF's measurement of the particle's mass is significantly lower than a previous measurement, leaving researchers wondering what caused the discrepancy.

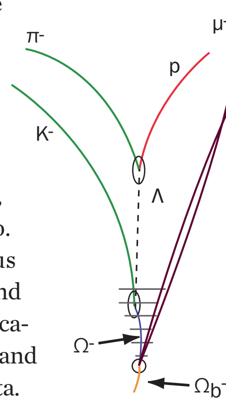
"One or both of the measurements are missing the mark," says CDF physicist Pat Lukens, a coauthor of the paper.

DZero, CDF's sister detector, had observed the omega-b-minus in fall 2008 using the same accelerator, the Tevatron, at Fermilab (*SN: 9/27/08, p. 9*). Although CDF's recent mass measurement of 6.054 billion electronvolts agrees better with the expected mass for an omega-b-minus particle than DZero's measurement of 6.165 billion electronvolts, the mismatch in the results is disconcerting, the researchers say.

"We don't have an explanation," says Darien Wood of Northeastern University in Boston, cospokesman for DZero. "We checked for obvious errors, and we haven't found any." Such discrepancies occasionally come up, he says, and are resolved with more data.

The standard model of particle physics predicts the existence and mass of this particle, which is a baryon, like protons and neutrons, and is made up of two strange quarks and a bottom quark.

The elusive particle is rarely seen but does play a supporting role in a grander enterprise, says Fermilab's Andreas Kronfeld. "If the standard model were a movie, you wouldn't get Robert De Niro to play the omega-b baryon," Kronfeld says. But understanding the properties of such particles helps scientists answer larger questions, such as why the universe is made mostly of matter instead of antimatter.



The omega-b-minus baryon decays too quickly to be detected directly, but its presence is signaled by a telltale cascade of particles.

FROM TOP: N. MOORE *ET AL.*/*NANO LETTERS*; CDF COLLABORATION