science-advisory roles in their own countries, rather than just ceremonial roles."

Biochemist Ernst-Ludwig Winnacker, head of Germany's DFG granting agency, thinks the IAC "would be very useful." Winnacker, who attended the Davos meeting, adds: "The question is whether the U.N. or other international organizations would take advantage of it." Whether policy-makers will seek advice on burning scientific questions remains to be seen, but the Davos participants were upbeat. Says Alberts: "We all agreed that the world needs much more advice from scientists." –ROBERT KOENIG

MATERIALS SCIENCE

New Material Promises Chillier Currents

A moth frying on a bug lamp proves, suicidally, that an electrical current heats. But a current can also cool, if it runs through the right stuff. A handful of exotic semiconductors wick away heat while conducting electricity, and heat pumps fashioned from them chill solid-state lasers, radiation detectors, and fancy picnic coolers. Easily miniaturized and free of moving parts, such heat pumps offer clear advantages over mechanical refrigerators.

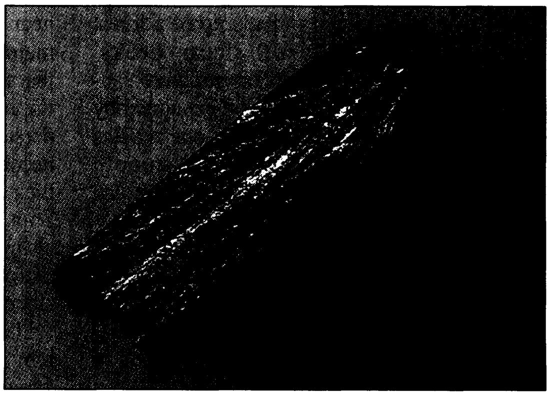
Unfortunately, good thermoelectric materials are few and far between; research labs haven't turned up a promising new one for decades. Now a team led by Mercouri Kanatzidis, a chemist at Michigan State University in East Lansing, may have broken the impasse with a concoction of bismuth, tellurium, and cesium. "This is the first material that suggests we can do as well as or better than the materials we've had for the last 30 years," says Frank DiSalvo, a chemist at Cornell University in Ithaca, New York.

As Kanatzidis and colleagues report on page 1024, the new material (chemical formula $CsBi_4Te_6$) cools nearly as efficiently as the best material currently available. But whereas its decades-old rival conks out at –50° Celsius, the new stuff keeps working to roughly –100°C. It therefore promises to improve the performance of laser diodes, infrared detectors, and other electronic devices that run best cold. Researchers cheered the newcomer's arrival. "Kanatzidis is doing some super work in this field," says Galen Stucky, a chemist at the University of California, Santa Barbara.

Semiconductors come in two breeds, *n*-type and *p*-type. A thermoelectric heat pump consists of a chunk of one butted against a chunk of the other. In the *n*-type, electrical current is carried by negatively charged electrons, which, thanks to an awkward historical convention, are considered to flow in the direction opposite to the current. In the *p*-type, current is carried by positively charged "holes," the shadows of absent electrons, which flow in the same direction as the current. When current flows out of the *n*-type semiconductor and into the *p*-type semiconductor, both the electrons and the holes stream away from the border between the two materials. Like steam whistling out of a teakettle, the fleeing holes and electrons carry away heat, cooling the junction.

Of course, for the heat pump to work, the electrons and holes must usher heat away faster than it can flow back. And that means thermoelectric materials must have high electrical conductivity and low thermal conductivity. It also means each electron or hole must carry a healthy dollop of heat. Unfortunately, the three properties are closely connected and often work against one another. For example, boosting the electrical conductivity too high leaves wimpy electrons and holes that carry only tiny amounts of heat.

Kanatzidis and his team set out to systematically improve upon the best material available, a compound of bismuth, antimony, tellurium, and selenium. The researchers first synthesized a potassium, bismuth, and selenium compound with promising properties. They then tried to replace the potassium and selenium atoms with heavier cesium and tellurium atoms, to make a softer substance that would better damp heat-carrying vibrations. But things didn't go quite as planned. The new material took on a surprising crystal structure, which, however, performed even better than expected. "In some ways, it's a little bit of serendipity," Kanatzidis says. But others credit more than luck. "I don't think this is so much an accident as it is his very clever way of looking at things," Stucky says.



Chilly crystal. The new thermoelectric material carries away heat while it conducts electricity along its needlelike grains.

CREDIT: M. KANATZIDIS/MICHIGAN STATE UNIVERSITY

The new material needs fine-tuning, Kanatzidis says. He and his team have not yet

ScienceScope

Entrepreneurs Wanted Japan's Ministry of Education (Monbusho) hopes that new legislation can achieve what its lobbying could not—spur technology transfer by allowing national university professors to serve as officials of private corporations.

Last year Monbusho officials thought they had government-wide support to exempt professors from the National Civil Service Law, which prevents civil servants from simultaneously holding private sector positions. But the National Personnel Agency refused to allow economist Iwao Nakatani of Hitotsubashi University in Tokyo to accept a seat on the Sony Corp. board of directors (*Science*, 18 June, p. 1905). Nakatani resigned his professorship to join Sony's board, then went back to the university as a part-time lecturer, a position not subject to the regulations. The incident led Prime Minister Keizo Obuchi to set up an intragovernmental study group, which drafted a reform proposal that was presented to legislators this week. "This time, we really have the backing of the entire government," says a Monbusho official.

Molecular biologist Shiro Kanegasaki, who had to retire last year from the University of Tokyo before starting the Effector Cell Institute, sees the proposed law as a boon to entrepreneurs. "A lot of younger bioscience and medical researchers would be quite happy to have a role" in the private sector, he says.

Strength in Numbers In a leap ahead for Dutch science, the Netherlands Organization for Scientific Research has decided to buy a new national supercomputer that will be more powerful than any other in Europe. The $14 million machine, a Scalable Node-1 from hardware producer SGI, has over 1000 parallel processors and is able to perform a trillion calculations per second. That's almost 100 times faster than Holland's current top number cruncher.

Some 120 research groups will use the new machine—due to be up and running in November—to model everything from bone growth to the birth of galaxies. Chemist Evert Jan Baerends of Amsterdam's Free University, who uses supercomputers to model interactions between molecules, says the new machine will be "a big step upward."

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