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SINGLE-ATOM CURRENT HEEDS ORBITAL COUNT

Electronic wires and devices, getting smaller every year, may eventually shrink to single-atom dimensions. A new study of one-atom electric contacts finds that their conductivity depends on different properties than does the bulk-metal conduction in today's circuitry.

In bulk metal, conductivity is limited by the presence of crystal defects and impurities that impede electron flow. The conductivity of single atoms, however, depends on their individual chemical properties, report Elke Scheer of the University of Karlsruhe in Germany and her colleagues in the July 9 Nature.

In particular, experiments on lone atoms of aluminum, gold, lead, and niobium reveal that metals with more valence-electron orbitals can pass more current because they have more conduction channels available. Valence electrons, which are located in outer orbits, participate in chemical bonds.

As a single atom, one of the best bulk conductors now in use - gold -became the least conductive of the four metals tested. With only one valence electron, gold boasts only one conduction channel, whereas lead atoms - in bulk only a tenth as conductive as gold allow three channels.

The researchers also found that single atoms of metal could transmit up to 100 microamperes of current. That robust flow bodes well for the future of single-atom electronics, says Lydia L. Sohn of Princeton University, "because it shows that atomic-sized devices could handle currents on the same order of magnitude as today's devices."

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By Peter Weiss
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