study represents a technically challenging development. Issues of mechanical and thermal stability present particular difficulties for detecting the movement of charge between atoms buried deep within a semiconducting layer — doing so requires an STM that can operate at milliKelvin temperatures with $0.01\ e\ \mathrm{Hz}^{-1/2}$ charge sensitivity. Such a capability is currently available only to a limited number of research groups worldwide.

Arguably, the authors could be criticized for not presenting data from more than one sample. However, the measured sample is a randomly doped delta-layer, which essentially represents an infinite number of samples of differing dopant distribution depending on tip location. The authors present similar-looking molecular data from one location of the sample, and also averaged over three locations of the sample. As such, the experimental data reported seems convincing. But a test of their approach will be to apply it to a system that has been fabricated with true atomic precision, to study the interaction between dopants whose position and therefore coupling is well defined. Such atomic precision of dopant placement is being pursued by several groups in which individual atoms are manipulated using STMs[9–11]. The next step for experiment is the realization of engineered single-dopant-atom devices and the ability to couple these in a controlled manner.

The importance of the results presented by Kuljanishvili *et al.* span many different emerging fields. There is a growing interest in single-dopant-atom architectures and their coupling for future quantum information technologies, quantum cellular automata and precise single-electron transistors. In addition, as commercial transistors scale down below the 32 nm node, where only tens of dopant atoms exist in each device, the role of individual dopants in transistor operation is becoming paramount[12]. Most important of all, though, the ability to probe the energy levels of single dopant atoms and their coupling paves the way to the development of a fundamental understanding of few-body quantum mechanical systems — particularly in the realm of *ab initio* computational techniques. Despite significant improvements in computing power, the ability to simulate the quantum mechanical behaviour of large systems from first principles is still limited. But by enabling experimental access to such behaviour at the level of individual atoms, techniques such as those demonstrated by Kuljanishvili *et al.* are bringing us to the point where experiments and simulations will soon converge. With this ongoing development, we will begin to see an exciting transformation in the way theorists and experimentalists work together in developing future semiconductor technologies, and in understanding the quantum world.

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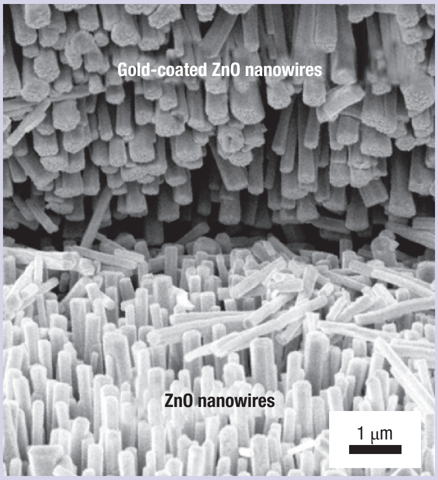
ENERGY HARVESTING

Rubbed the right way

Anyone who has received an electric shock from a colleague after walking across a synthetic carpet knows that even the most mundane of activities can generate energy. But is there any way that this energy can be harnessed? Yong Qin and colleagues suggest it could (*Nature* **451,** 809–813; 2008), using fabrics made of specially coated fibres that produce electricity through the piezoelectric effect.

The authors' fibres consist of two intertwined strands of Kevlar. On one of the strands they grow a forest of radially aligned bare zinc-oxide nanowires, and on the other a similar coverage but of gold-coated nanowires (pictured). Stretching one of the strands back and forth along the length of the second strand causes the nanowires to rub against each other. This rubbing causes the bare zinc-oxide nanowires to bend, which, owing to the piezoelectric characteristics of the oxide, causes a separation of charge to develop across the diameter of each wire. As this happens, the rectifying metal–semiconductor junctions that form at the points of contact between the opposing sets of nanowires allow only negative charge to pass from the bare nanowires to the gold-coated nanowires. This, in turn, generates a voltage across the two strands.



From a single double-stranded fibre, the authors generate peak closed-circuit currents of around 5 pA. By entangling multiple strands together — which increases the area of contact between opposing nanowires — this current can be increased by a factor of up to 50, to an average output current of 200 pA for a six-stranded bundle. And by reducing the core resistance of the strands by depositing a conducting layer before the nanowires, they improve the output of their double-stranded fibres by three orders of magnitude.

One of the advantages of Qin and colleagues' fibre-based generators — compared with previously reported schemes for generating electricity with piezoelectric nanowires — is that they operate at low frequency, which means they can produce power from a wider range of sources of mechanical vibration, such as that generated by someone's physical movement. The flexibility and low-temperature growth conditions of the system are other advantages. By weaving these fibres into a 'power shirt', the authors estimate that up to 20–80 mW of power could be generated by one square metre of fabric — comparable to the power used by a personal music player.

Ed Gerstner