Minuscule Power Plants, With Potential Uses In Tiny Devices

The term "power plant" conjures images of giant boilers and huge turbines fueled by oil, coal or a nuclear reactor.

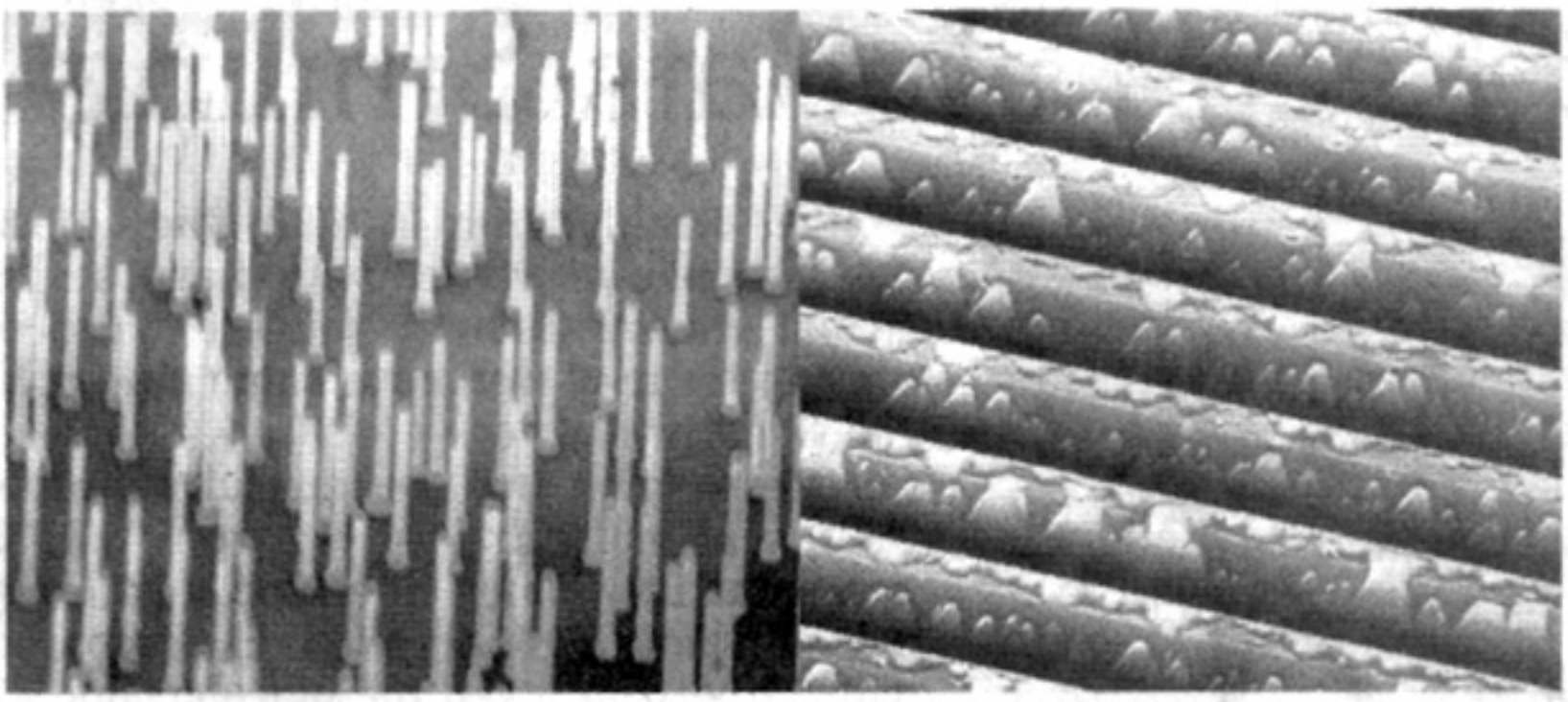
But power plants can be much smaller in scale. Take the one designed by Zhong Lin Wang and colleagues at the Georgia Institute of Technology. Its working components are on the order of a millionth of a meter high and 40 billionths of a meter wide. It is "fueled" by ultrasonic waves or other vibrations.

This nanogenerator, described in a paper in the journal Science, expands on earlier work by some of the same researchers, who demonstrated that a zinc oxide nanowire, when bent by the tip of an atomic force microscope, generates an electric current by the piezoelectric effect.

But using an expensive lab instrument to bend one nanowire to create a tiny amount of electricity is hardly efficient. The new work replaces the microscope with a flat, platinum-coated silicon electrode into which a series of ridges has been etched. This electrode is placed on top of an array of hundreds of nanowires that have been grown on a substrate that functions as a second electrode.

The result is a sandwich, with the vertical nanowires between the two electrodes. When vibrations make the top electrode move, many of the nanowires bend, creating a small direct current.

With enough nanowires, and improvements in efficiency, the researchers say, such a generator may someday be useful in powering tiny nanoscale devices in places where battery power is not practical — inside the body, perhaps, where even the pulsations of blood flow might provide the vibrational fuel.



Photographs by Zhong Lin Wang/Georgia Institute of Technology

When zinc oxide nanowires grown on a gallium nitride substrate, left, are bent by a ridged platinum-coated electrode, right, a small current is generated.