Nanoswitches for Energy Savings Applications

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The Issue
Transistor technology has allowed electronics to get smaller and smaller. Transistors have their on and off states that correspond to high and low electric currents. So even when an electronic device is “off” it is using electricity and the transistor is wasting energy.

The Possible Solution
Mechanical switches (like light switches in your home) won’t allow current to flow when they are in the off position. When they are off no energy is wasted. In order for switches to be used in the microelectronics industry the switches will need to be extremely small: on the order of micrometers or nanometers.

The Difficulty
Fabrication of switches this small is a challenge. In addition, at this smaller size the properties of the materials can change. It is important to be able to characterize the properties of these switches both after they are made and after cycling them millions of times, to verify the suitability of these devices in consumer electronics.

Characterization of Fabricated Switches

The switches to the right were viewed through an optical microscope. The silicon switches are covered in gold to improve conductive properties of the switches.

To the right is an example of Auger mapping. It shows where specific elements are located on the nanoscale.

Below is a point survey, used to identify the elements present and their concentrations.

Development of SiC Nanoswitches

The switches being currently developed are made mostly of Silicon (Si). If they switches were made out of Silicon Carbide (SiC) it would improve their durability and strength as well as their ability to function at higher temperatures. The SiC cantilevers on the right are about one-tenth the thickness of a human hair.

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