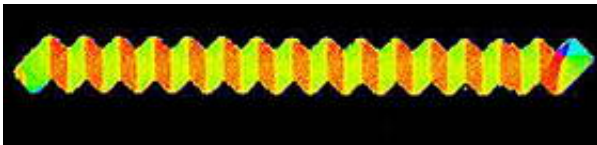


Novel Zigzag Shape Gives Sensors Magnetic Appeal

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Scientists at the National Institute of Standards and Technology (NIST) have designed tiny magnetic sensors in a "zigzag" shape that are simpler in design and likely will be cheaper to make than conventional magnetic sensors used in portable devices. The new sensors could someday be used to measure magnetic fields in applications such as compasses, weapons detection, medicine and non-destructive evaluation of structural materials.

Described in the Dec. 13, 2004, issue of [Applied Physics Letters](#),* the NIST sensors are made of a thin film of nickel and iron and are 35 micrometers long and 5 micrometers wide, with nanoscale design elements at the edges.

The graphic above shows how the direction of magnetization within a NIST zigzag magnetic sensor follows the shape of the device. The green and orange areas of the sensors act like tiny bar magnets with their north and south poles at a 45-degree angle to the centerline of the sensor.

The zigzag design produces the equivalent of many tiny bar magnets oriented with their north and south poles at a 45-degree angle to the centerline of the sensor (see image above). The device senses magnetic fields using a small electrical current sent down the centerline. Tiny changes in the magnetic field surrounding the sensor—such as when a steel weapon passes near it—will increase the resistance to the current and will be detected as an increase in voltage.

Portable magnetic sensors typically include multiple aluminum strips that alternate diagonally across the sensor. The new zigzag sensors are expected to produce clearer signals (less electronic "noise") by confining the current to the center of the device and by eliminating edge imperfections that can result in nanoscale magnetic fluctuations.

The project is part of an interdisciplinary NIST effort to design nanoscale sensors with improved detection levels. NIST scientists experimented with sensor width, length and other dimensions to achieve the desired performance. Engineering of the sensors was supported by theoretical work using NIST-developed imaging and modeling tools.

*F.C.S. da Silva, W.C. Uhlig, A.B. Kos, S. Schima, J. Aumentado, J. Unguris, and D.P. Pappas. Zigzag-shaped magnetic sensors. *Applied Physics Letters*, Vol. 85, pp. 6025-6027, Dec. 13, 2004.

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