Microwires as mobile phone sensors

January 28 2014

This is Alexander Chizhik. Credit: UPV/EHU

Microwires were created in the former Soviet Union for military purposes. They formed the basis of the camouflage of a model of spy plane used by the Soviet army, but for a long time the scientific community has been studying them for other purposes. A study by the UPV/EHU's Magnetism Group is making progress in furthering understanding of the surface magnetic behaviour of glass-coated microwires and has concluded that they are the major candidates for use as high sensitivity sensors, in mobile phones, for example.

Microwires have a metal core and a crystal skin, in other words, they have a glass coating. The core of the microwire consists of a ferromagnetic alloy, which varies according to the metals used in the alloy and the final geometry of the wire. "But there is a quality that they all share: they have magnetic properties. It is precisely their magnetic properties and small size that account for the fact that they are so prized," pointed out Alexander Chizhik, a member of the Magnetism group.

"One of the possibly best-known applications with respect to microwires is that they can be used as sensors in the electronic compasses of mobile phones," said Chizhik. "These are sensors that allow the position of the mobile phone owner to be determined in space just as if the device were a GPS." Like the sensors in mobile phones, various sensors developed in collaboration with the Japanese company Aichi are currently being used in the automotive industry or in traffic surveillance vehicles.

Magnetic structure

Right now, the mass production of these sensors is closely related to the ability to reproduce the properties of the wires and the homogeneities of these properties throughout the length of the microwire. So "the main task in our work is to choose the optimum parameters of the magnetic microwires in order to obtain a higher level of reproducibility," explained Chizhik.

That is why the aim of this research is part of the intense work that the Magnetism group has been carrying out over the last 25 years involving studies into the magnetic properties of new materials. In this context, "particular attention has been paid to the quest for new applications for these tiny wires," explained Alexander Chizhik. "Our study makes it possible to go further into the understanding of the surface magnetic behaviour of glass-coated microwires," he added.

Specifically, the UPV/EHU's Magnetism Group has concentrated on studying the magnetic structure of microwires. They are using a laser to do this. The light emitted from this device is reflected onto the microwire and gathers all the information about the microwire's magnetic, electrical, and atomic, etc. structure. "Let's say this microwire functions like a mirror," added the Magnetism Group researcher. That way "we have managed to study the magnetic structure of the microwires in depth and see that they display a unique structure of magnetic domains," as Alexander Chizhik pointed out. "This structure of magnetic domains provides microwaves with great sensitivity. It is a very important factor to take into consideration, because sensors have to have a degree of sensitivity that is higher than the rest in order to pick up low-intensity signals," he added.

He concluded by saying, "Thanks to this study, we have also verified that if we apply an electric current to microwires, the magnetic domain structure varies; so this is an important factor for these sensors to work well".

More information: A. Chizhik, A. Stupakiewicz, A. Zhukov, A. Maziewski, J. Gonzalez. Experimental demonstration of basic mechanisms of magnetization reversal in magnetic microwires. *Physica B: Condensed Matter*. www.sciencedirect.com/science/ … ii/S0921452613005978

Provided by Elhuyar Fundazioa