Flexible nanosensors for wearable devices

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A new method developed at the Institute of Optoelectronics Systems and Microtechnology (ISOM) from the Universidad Politécnica de Madrid (UPM) will enable the fabrication of optical nanosensors capable of sticking on uneven surfaces and biological surfaces like human skin. This result can boost the use of wearable devices to monitor parameters such as temperature, breath and heart pressure. Additionally, it is a low-cost technology since they use materials like standard polycarbonate compact disks, aluminum films and adhesive tapes that would facilitate its implementation on the market.

Researchers from Semiconductor Devices Group of ISOM from UPM have not only designed a manufacturing method for optical nanosensors using regular adhesive tape but have also shown their potential applications. These flexible nanosensors enable measurement of refractive index variations of the surrounding medium, which can be used to detect chemical substances. They also display iridescent colors that can vary according to the viewing and illumination angle, facilitating the detection of position variations and surface topography at a glance.

Nanosensors consist of dimensional nanohole arrays (250 nm) which are drilled into an aluminum layer (100 nm thick). In order to cause sensitivity to the surrounding mediums and iridescence effects, these nanostructures confine and disperse light according to designer specifications.

The creation method for flexible nanosensors consists of manufacturing sensors over a compact disc (CD) of traditional polycarbonate. These

sensors are transferred to adhesive Scotch tape by a simple stick-and-peel procedure. Thus, the nanosensors go from the CD surface to the adhesive tape (flexible substrate).

This new technology uses low-cost materials such as polycarbonate CDs, aluminum, and regular adhesive tape. The usage of noble metals to develop these types of sensors is common, but mass production is difficult due to the high cost.

Aluminum is 25,000 times cheaper than gold and has excellent electrical and optical properties. CD surfaces provide adherence to aluminum that is strong enough to manufacture the sensors over the CDs and weak enough to be transferred to the adhesive tape.

This research is led by Dr. Carlos Angulos Barrios, a researcher from ISOM and Professor at the Department of Photonics Technology and Bioengineering (TFB) of the School of Telecommunications Engineering, and also led by Víctor Canalejas Tejero, a PhD student of ISOM. The results were published in the *Nanoscale* journal.

More information: BARRIOS, C.A.; CANALEJAS-TEJERO, V. "Compact discs as versatile cost-effective substrates for releasable nanopatterned aluminium films". *Nanoscale*, 2015, DOI: 10.1039/C4NR06271J.

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