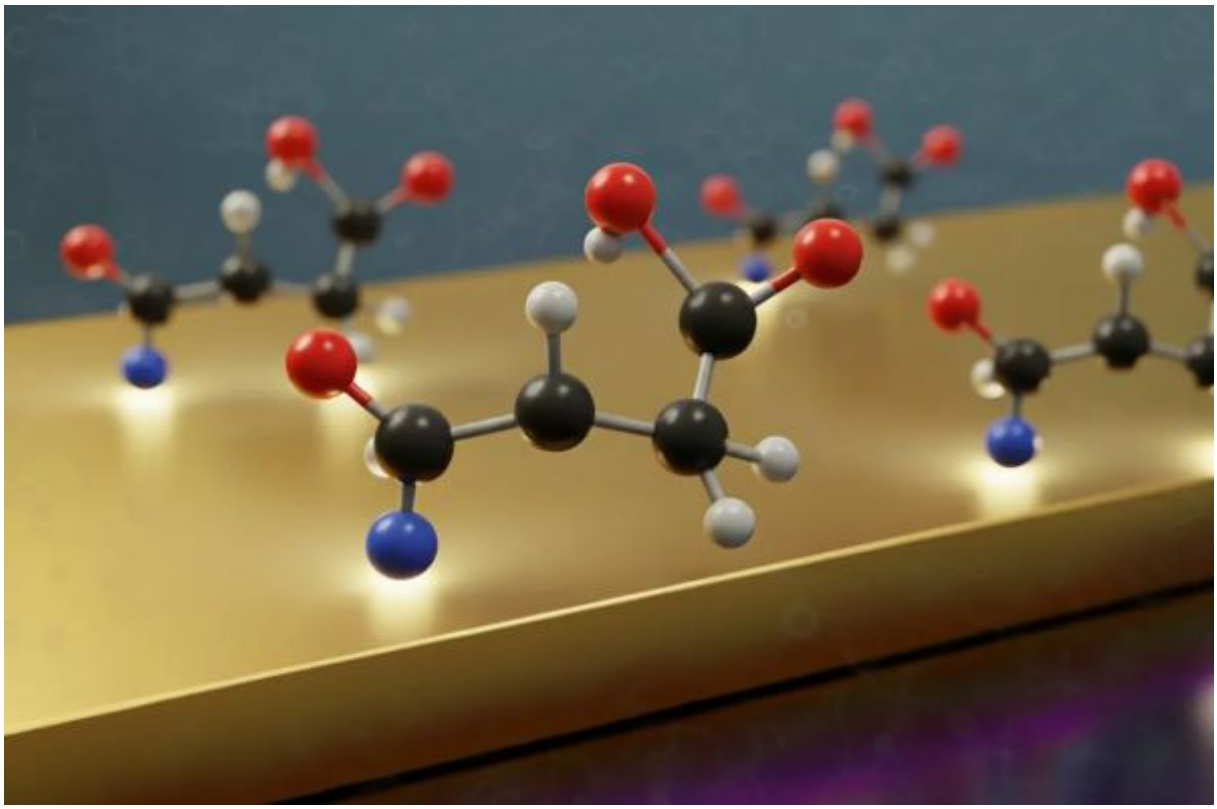


Thinner gold films, better biosensors

ICFO researchers have explored, for the first time, how the thickness of metal films in biosensors affects device performance. The study, recently published in APL Materials, demonstrates that the thinner the gold films, the stronger and faster the biosensor's response. This highlights the potential of ultrathin gold films for advanced biosensing applications, including wearable healthcare devices and air quality monitors.

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Modern society faces a growing demand for faster and more reliable sensors capable of detecting chemical and biological changes in real-time. Point-of-care diagnostics and portable or wearable healthcare monitoring devices, for instance, could greatly benefit from such advanced biosensors. Promising candidates are **chemiresistors**, sensors that convert chemical interactions between their surface and target molecules into a measurable change in electrical resistance. So far, most researchers have used relatively thick metal films or graphene (a two-dimensional material) to build them. But, still, a fundamental question remains: what is the role of film thickness in the sensor's response? Could one improve

sensor performance simply by employing thinner metal films?

A team of ICFO researchers, including **Dr. Javier Arres Chillon**, **Dr. Daniel Martinez Cercos**, **Dr. Ewelina Wajs**, led by **ICREA Prof. Valerio Pruneri**, and in collaboration with Dr. Prantik Mazumder from the USA, have now explored for the first time these unknowns by creating biosensors made of **ultrathin gold films**. Obtaining metallic films just between 2 and 8 nanometers thick, however, is not a straightforward task, because such a small thickness makes them extremely sensitive to even minor variations during fabrication, which significantly alters their electrical response and stability. The team spent several weeks of iterative optimization trying to solve this issue, an arduous process that finally allowed them to show that the sensor's response indeed depends on the film thickness.

i¿½Through real-time resistance measurements, we observed that **the response becomes stronger and faster as the film becomes thinner**,i¿½ explains Javier Arres Chillon, first auth r of the article. i¿½This is important because it demonstrates that chemiresistors base on ultrathin metal films can achieve enhanced sensitivity and faster response times compare to thicker films,i¿½ he adds. Their work, recently published in APL Materials, culminated in **a proof-of-concept biosensor** made of these ultrathin gold films, upon which a self-assembled monolayer (SAM) of thiol-based molecules was deposited. This monolayer increased the resistivity of the sensor and, at the same time, was able to bind to specific target molecules, enabling **selective sensing**. In particular, the platform was tested by detecting streptavidin, one of the most well-established binding systems in biosensing, allowing for accurate validation of the system.

The researchers recognize that further improvements in SAM engineering could enhance the device performance even further. Yet, the current study already marks a key step forward in the field by confirming the potential of ultrathin gold films for real-time biosensing.

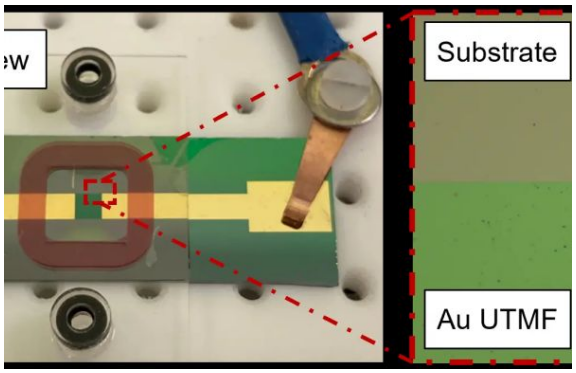
Reference:

Javier Arres Chillon, Daniel Martinez-Cercos, Ewelina Wajs, Prantik Mazumder, Valerio Pruneri; Ultrathin gold films with chemiresistive functionality. APL Mater. 1 April 2026; 14 (4): 041106. DOI: https://doi.org/10.1063/5.0319015

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Photograph of the chemiresistive sensor, liquid cell, and connections to the electrical electrodes. Source: APL Materials.