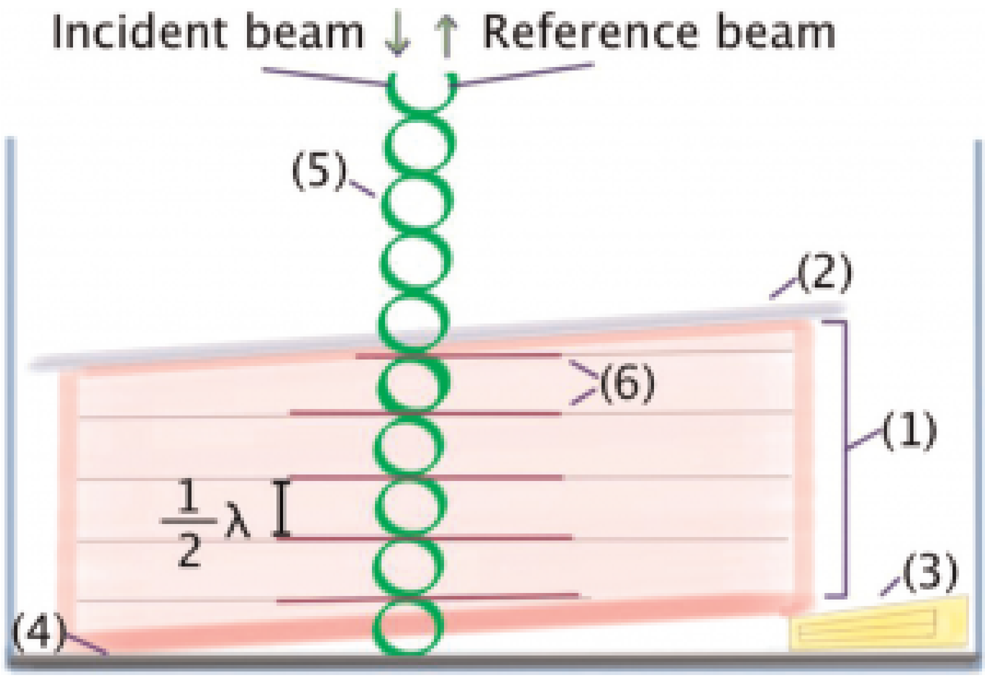
A near infrared holographic glucose sensor

Evangelia Vezouviou et al., have reported a near infrared holographic glucose sensor. Real-time glucose monitoring has been beneficial in reducing health complications associated with diabetes as well as a decrease in mortality. This report describes a novel holographic platform, fabricated via laser ablation on chitosan hydrogel with gold nanoparticles with a replaying in visible and near IR. The sensor responded with a 12nm and 7nm shift in waveleng that glucose concentrations in the 0.70 mM range and in the visible and near IR, respectively, at pH 7.4 and an ionic strength of 154 mM. The sensor did not respond to potential interferences found in the interstitial fluid, such as fructose, vitamin C and lactate, at the irrespective normal concentrations and was stable to fluctuations in temperature, pH and ionic strength. The characteristics of this sensor suggest that it may be applicable for use as an implanted device for the real time monitoring of glucose concentrations in the interstitial fluid using near IR as the interrogating medium.



Holographic fabrication. A photosensitive emulsion (1) coated on a glass slide (2) is placed inside a tray with a 7° spacer (3) and facing towards a reflecting mirror (4).Upon exposure to the laser irradiation (5), the gold nanoparticle grains are arranged in fringes (6) align in parallel to the surface of the polymer, and are separated by half the distance of the wavelength they were exposed to. The diagram is not to scale.

Refrence:

Evangelia Vezouviou, Christopher R. Lowe – 2015 – Biosensors and Bioelectronics 68 ,371–381.

http://dx.doi.org/10.1016/j.bios.2015.01.014.

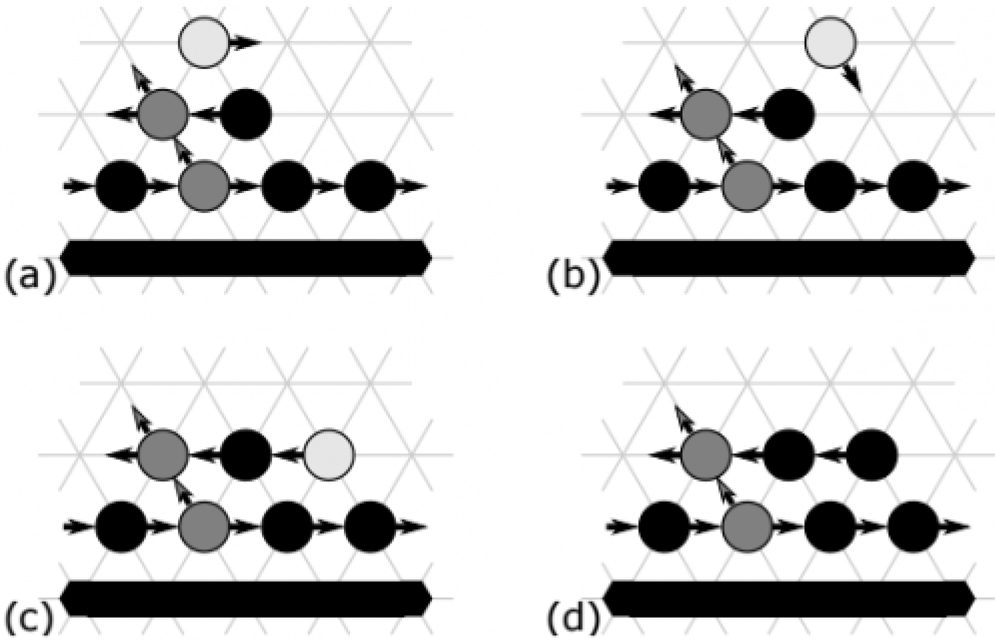
News sent to our group by Ms. Khajemiri

Programmable Material Algorithm Solves Universal Coating Problem

If you want to measure the temperature at any point on an object’s surface, a thin coating of programmable material can do the job, say computer scientists.

- January 11, 2016

The world is full of complex structures such as bridges, roads, wind turbines, power stations, and so on, that have to be carefully monitored to ensure their integrity.



Today, much of this work has to be done by engineers on the spot. That’s not so easy for objects that span hundreds, or even thousands, of kilometers, such as roads, or remote structures such as offshore wind turbines.

So a way of doing this remotely would be hugely valuable. Clearly it requires some kind of independent sensor that can measure the required property such as temperature or acidity, or cracking, and so on.

And indeed there are numerous gadgets for doing this. For example, optical fibers attached to or embedded in objects can measure the forces acting on it and sensors attached to these fibers can monitor temperature, acidity, and so on.

But these kinds of sensors do not provide global coverage—they cannot tell you the temperature at any point on the object. For that you need something more ambitious.

The dream would be to have a smart coating that does this job. This would be a “programmable material” that entirely coats an object in a thin layer. It would contain tiny particulate sensors that gather information about the surface, such as its temperature, and communicate it to their nearest neighbors.

While mathematicians have long pondered the properties of programmable materials, one question has stumped them. Is it possible to use a smart coating to determine the temperature at any point on an arbitrary object, even though the sensors have no knowledge of its overall geometry?

Today, we get an answer to this question thanks to the work of Zahra Derakhshandeh at Arizona State University in Tempe and a few pals. They’ve developed a series of algorithms that provide the mathematical framework that allows these particles to solve this problem.

To make this work, the particulate sensors and the coating must have certain properties. Derakhshandeh and co say the sensors must be able to move within the surface and to make, and break, communication bonds with their nearest neighbors. The object must have a geometry that allows a uniform coating.

Under those conditions, Derakhshandeh and co say that their framework functions as a universal coating algorithm for programmable matter. The particles need only have limited memory and communicate only over short distances and are entirely anonymous—in other words they are all equivalent.

That's curious work that could one day lead to some useful applications in remote monitoring.

There is still work to be done, however. Given the task of measuring some property of the material at a specific point, one important problem is how quickly the algorithm can do this. To find out, the team suggests testing the algorithm in a simulation or with real programmable matter. It will be interesting to see how they get on.

Another important problem will be the energy efficiency of this kind of programmable matter. What kind of communications overhead does the coating problem impose and could the energy for this conceivably be harvested from the environment?

It's still early days for programmable matter and for a universal coating. But the savings that Derakhshandeh and co's algorithms might allow are considerable, given the cost of monitoring and maintaining off shore wind turbines, for example. That alone should guarantee further interest in this topic for the future.

Ref: http://arxiv.org/abs/1601.01008 : Universal Coating for Programmable Matter

https://www.technologyreview.com/s/545346/programmable-material-algorithm-solves-universal-coating-problem/

News sent to our group by Ms. Asghari