Scientists report revolutionary sensors capable of detecting carcinogenic foods

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Specialists at the National Research Nuclear University MEPhI and institutional collaborators have proposed a concept of hypersensitive sensory transducers (Fourier nano transducers) that could drastically

revolutionise ultrasensitive control in biomedicine and a whole range of other spheres. The results are published in *Advanced Functional Materials*.

Fourier nano transducers are monolayer architectures of gold nanoparticles arranged on the surface as nano-periodic structures in such a way that their illumination leads to a plasmon disturbance (electromagnetically bound collective resonances of free radicals) in the metal system.

These transducers are capable of concentrating the electric field of a light wave in a super-thin layer, thus obtaining information about its optic properties in the form of specially coded correlations, or ratios between light wave phases, before further transmitting it in reflected or diffracted light rays.

Dr. Andrei Kabashin, scientific director of the Institute of Engineering Physics for Biomedicine at the MEPhI National Research Nuclear University, said, "Such light wave field concentration, coding, and phase information transition helps arrive at the unprecedented sensitivity of a whole system to changes in the optical properties of super-thin layers, including atomic layers of 2-D-materials and molecular layers of biomaterials on the surface of biosensors."

According to Kabashin, the hypersensitivity of the proposed nano-transducers is seen in the registered ferroelectric effect from the atomic layer of molybdenum diselenide (MoS_2, alternative to graphene). The scientists say that such a minute effect registered from the atomic layer is unprecedented, and ushers in a whole new era for 2-D material research.

Another example of such hypersensitivity is a new methodology to detect the antibiotic chloramphenicol, widely used in the medicine and

food industries. It is vital to keep full control over its concentration in foods, as it leads to oncological diseases and cardio dysfunctions in excess.

The research has demonstrated that Fourier nano transformers boost the chances of detecting the antibiotic a thousand-fold as compared with other approaches. They are predicted to prove effective in a range of spheres—for instance, early diagnoses of dangerous illnesses, as well as ultrasensitive doping control, monitoring the quality of food and environmental conditions.

In a parallel study, the research group, together with Russian scientists from the Lebedev Physical Institute of the Russian Academy of Sciences, came up with a unique way of using silicon nanoparticles for cancer diagnostics. As Dr. Kabashin explained, scientists may soon find it possible to "reconsider the problem of bio-imaging for one of the most promising nanomaterials."

More information: *Advanced Functional Materials* (2019). onlinelibrary.wiley.com/doi/ab … .1002/adfm.201902692

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