KONWERSATORIUM INSTYTUTU FIZYKI UMCS

24.11.2022 r., (czwartek) godz. 11^{15}, Aula IF im. St. Ziemeckiego

Dr hab. inż. Barbara Kościelska, prof. PG

Division of Nanomaterials Physics, Institute of Nanotechnology and Materials Engineering, Faculty of Applied Physics and Mathematics, Gdańsk University of Technology, ul. Gabriela Narutowicza 11/12, 80-233 Gdańsk, Poland

Fascinating properties of plasmonic nanostructures: from 2D to 3D systems

Metallic nanostructures, although known for years, still attract the attention of scientists. Due to their many interesting properties, it is possible to use them in modern technologies. One of the most interesting effects they are characterized by, and which can be used, for example, in nanosensors or surface enhanced Raman spectroscopy, is localized surface plasmon resonance (LSPR). The most frequently used metals in this case are Au and Ag. It is because of their large number of free electrons, which allows to achieve high plasma frequency and a negative real permittivity in a wide range of wavelengths. It is worth noting that LSPR can be observed regardless of whether the nanostructures cover the surface of the support (2D system) or are arranged in a matrix (3D system).

Here, examples of plasmon resonance and the possibilities of its application, both in 2D and 3D systems will be presented. At the beginning, starting from 2D system, manufacturing method of Au and Ag nanostructures and their plasmonic properties will be shown. The manufacturing method in this case is based on the thermal dewetting of thin metal films deposited, for example, on a silicon or glass substrate. Thanks to the appropriate selection of layers, in terms of their sequence and thickness, it is also possible to obtain Au-Ag nanoalloys. Using computational methods such as machine learning, you can even design nanostructures exhibiting LSPR at a specific and expected wavelength.

In turn, an example of 3D system may be silver nanoparticles arranged in a glassy matrix, doped with rare earth ions. Due to their plasmonic properties, they can enhance the intensity of the luminescence emission as well as influence the color of the emission. Of course, it is very important in this case to select the components forming the glass in order to minimize energy losses due to multi-phonon relaxation processes.

Uprzejmie zapraszam wszystkich pracowników, doktorantów i studentów Instytutu Fizyki.

Dr hab. Ryszard Zdyb, prof. UMCS
Dyrektor IF UMCS