Bimetallic nanostructures on porous silicon with controllable surface plasmon resonance

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2019

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Keywords: Bimetallic nanostructures, Surface enhanced, Raman scattering.

Abstract: The most intensive surface plasmon resonance (SPR) band is typical for the metallic particles of 10-150nm diameters. The SPR band of such nanoparticles is usually narrow and allows using just one laser (i.e. limited range of excitation wavelength) to achieve the maximal enhancement of electromagnetic field near metallic nanostructures caused by surface plasmon oscillations. It hinders usability of plasmonic nanostructures in some application including surface enhanced Raman scattering (SERS) spectroscopy. To overcome this hurdle enlarged metallic nanostructures are fabricated resulting in a broadening of the SPR band due to additional oscillation modes. However, the SPR bands of the enlarged particles are characterized by less intensity and weak

enhancement at different wavelengths. In this paper, we proposed an alternative way for the SPR band broadening by use of bimetallic nanostructures on a sculptured template. Plasmonic substrates were fabricated by sequential copper electroplating and silver electroless deposition on porous silicon. Presented data implies that variation in morphology and ratio of the silver/copper nanostructures allow to control position of their SPR band from blue to near-infrared (IR) range. It is shown that SERS-spectroscopy with the fabricated nanostructures provide equal detection limits of rhodamine 6G under red and near-IR excitation wavelengths.

This article published in: Bimetallic nanostructures on porous silicon with controllable surface plasmon resonance / N. Khinevich [and others] // The European Physical Journal Plus. – 2019. – Vol. 134, Issue 2. – P. 75. – https://doi.org/10.1140/epjp/i2019-12567-4.

Internet link to the article:

https://link.springer.com/article/10.1140/epjp/i2019-12567-4.