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Laser-induced synthesis of silver nanostructures

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Surfaces functionalized with metal nanoparticles (NPs) are of great interest due to their wide potential applications in sensing, biomedicine, nanophotonics, etc. However, the precisely controllable decoration with plasmonic nanoparticles requires sophisticated techniques that are often multistep and complex.

The purpose of the study is to synthesize silver nanoparticles by laser-induced deposition from solutions; to establish the relationship between experimental parameters (wavelength, intensity and duration of laser exposure, composition and concentration parameters of deposition solutions) and the morphology of the synthesized nanostructures. The resulting nanostructures will be used to study the effect of surface enhanced Raman scattering, and the possibility of their use as active substrates for the detection and identification of persistent organic pollutants on the example of representatives of the nonylphenol family.

Here, we present a laser-induced deposition (LID) approach allowing for single-step surface decoration with NPs of controllable composition, morphology, and spatial distribution. The formation of Ag nanostructures on a substrate surface was successfully demonstrated as a result of the LID process from commercially available precursor [1].

LID is based on laser irradiation of substrate/solution interface. Formation of nanostructures takes place in the laser-affected area of substrate from precursor molecules dissolved in solvent. In our experiment LID process was realized with two laser wavelengths l=448nm, l=374nm, two solvents (isopropanol, water) and different laser irradiation time (10,20,40,60) min. Cover glass and quartz slips with 18 mm thickness and 5 mm × 5 mm size were used as substrates for LID. As a source of metal, we used one silver-containing precursors: silver benzoate hydrate(C_6H_5COOAg).

References

1) 1 Mamonova, D.V.; Vasileva, A.A.; Petrov, Y.V.; Danilov, D.V.; Kolesnikov, I.E.; Kalinichev, A.A.; Bachmann, J.; Manshina, A.A. Laser-Induced Deposition of Plasmonic Ag and Pt Nanoparticles, and Periodic Arrays. Materials 2021, 14, 10. http://dx.doi.org/10.3390/ma14010010