# Numerical analysis of the plasmonic spectra of Palladium, Copper, Platinum and Magnesium nanoparticles. New possibilities for UV plasmonics

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## Abstract

The use of metallic nanoparticles as nanosensors has an endless of applications in plasmonic nanotechnology. Some of them are based on the generation of Localized Plasmon Resonances (LPR), whose spectral characteristics (position and shape) are sensitive to size, shape and optical properties of the nanoparticle as well as to those of its surroundings. Typical plasmonic sensors are made of Silver and Gold, whose LPR's are located in the VIS-NIR range. As many biological molecules have absorption bands in the UV part of the spectrum, it is crucial to investigate in that spectral part, the behaviour of other metals, especially in situations where labelling is not feasible [1]. Gallium [2] and Aluminium [3] have recently shown to evidence good plasmonic performance in this range. The aim of this research is to analyze numerically the plasmonic efficiency shown by other possible metals in the UV like Palladium, Copper, Platinum and Magnesium nanoparticles. This will be done by using the Discrete Dipole Approximation (DDA) method [4]. Spherical and hemispherical particles, either isolated or located on sapphire substrates have been simulated in order to study the role of the substrate and the effect of the particle shape on the spectral peak positions and its overall structure.
In Figure 1 and Figure 2, DDA calculations of the spectral absorption efficiency ($Q_{abs}$) of the different metals are shown for R = 20 nm and for four different geometries. All calculations were done for S polarization and normal incidence.
As main conclusions we summarize the following: the spherical geometry shows less red shift in the absorption peak than the hemispherical one. Furthermore, Ag, Au, Al and Mg nanoparticles show higher energy plasmon resonances than the other materials. However, the spectral absorption efficiency of Ga, Pd, Pt and Cu nanoparticles shows an increase for high energies. This also makes them "good candidates" to develop plasmonic tools in the UV range.

## References

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## Figures

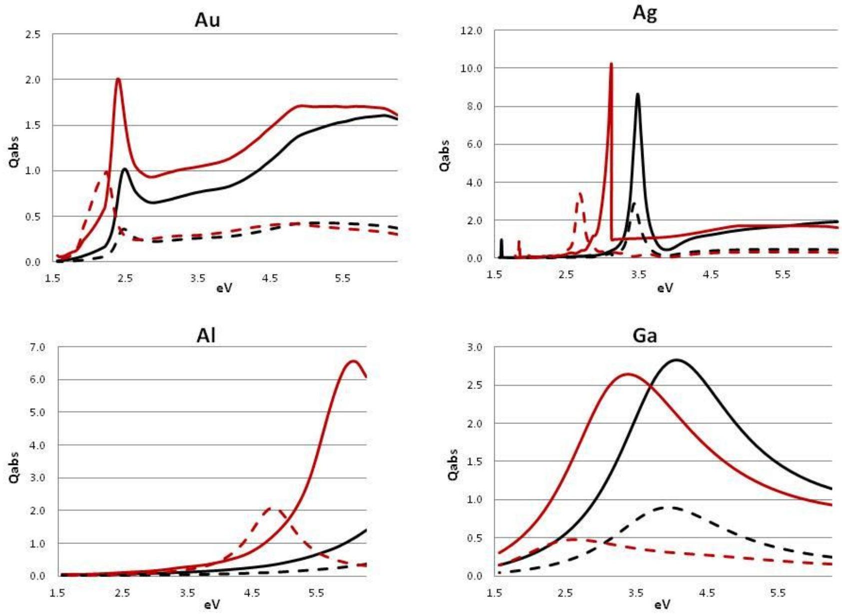


**Figure 1.** Spectral absortion efficiency (Qabs) of Au, Ag, Al and Ga spherical (black line) and hemispherical (red line) nanoparticles (radius 20 nm) isolated (continuous lines) and located on sapphire substrate (dashed lines).

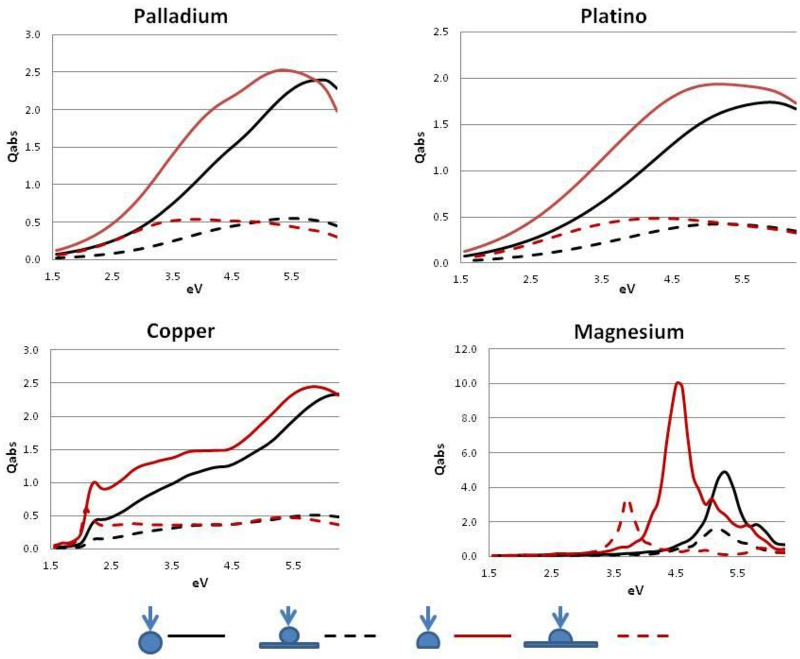


**Figure 2.** Spectral absortion efficiency (Qabs) of Pd, Pt, Cu and Mg spherical (black line) and hemispherical (red line) nanoparticles (radius 20 nm) isolated (continuous lines) and located on sapphire substrate (dashed lines).