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Synthesis of nanoparticles by magnetron sputtering of silver and gold onto castor oil

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Magnetron sputtering of metals onto liquids allows to obtain high purity solutions of nanoparticles (NPs) because this approach does not require the introduction of any reduction and/or stabilizing reagents used in the "classical wet" NP synthesis. Castor oil that withstand vacuum conditions might be a good alternative to ionic liquids and PEG which are widely used in the field of magnetron sputtering onto liquids because this oil has (***i***) low toxicity, (***ii***) good biocompatibility, and (***iii***) low cost.

Here we briefly describe our first results for the systematic study of magnetron sputtering of silver and gold onto castor oil. The effect of following parameters on the formation of NPs has been studied: *(1)* the sputter power; *(2)* the Ar pressure; *(3)* the sputtering time; *(4)* the type of sputtering plasma (DC-MS (Direct Current Magnetron Sputtering) vs HiPIMS (High-Power Impulse Magnetron Sputtering).

In case of DC magnetron sputtering of silver and gold a deep cloud of particles was obtained underneath the castor oil surface. No film formation on the liquid surface was ever observed. The obtained NPs were completely solubilized in the castor oil by mechanical stirring. Stability of the NPs solutions was characterized by UV-vis spectroscopy, the morphology of NPs was monitored using STEM. The concentration of metal in the solutions increases linearly with sputter power and deposition time and decreases exponentially with Ar background pressure.

Sputtering of silver with bipolar HiPIMS power supply leads to the formation of inhomogeneous mixture containing individual Ag NPs and their yellow agglomerates seen with a naked eye while sputtering of gold in the same conditions leads to the formation of homogeneous solutions of Au NPs.

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