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Magnetron sputtering of copper, silver and gold onto oils for nanoparticle synthesis.

LIQU / Plasma and liquids

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Abstract content

Magnetron Sputtering (MS) onto liquids allows obtaining high purity dispersions of nanoparticles (NPs - Fig.1). We studied the sputtering of Cu, Ag, and Au onto castor and rapeseed oil (and its polymers) as these vegetable oils are low cost and non-toxic, can be stored in air, and withstand vacuum. The effect of sputtering time and power, Ar pressure, type of sputtering plasma (dcMS vs Bipolar HiPIMS), and viscosity of host liquid are studied. The formation of a cloud of particles underneath the oil surface is observed (Fig.2) while films form for high viscosity oils. The scenario of NPs formation is inferred from experimental and theoretical analyses. Cu NPs oxidize rapidly in castor oil with formation of stable copper oxide NPs (3-10 nm for dcMS). Au NPs (2.4 - 3.2 nm for dcMS) have higher stability in castor oil than Ag NPs (1 - 4 nm for dcMS [1]) but secondary growth processes take place (Fig.1). Bipolar HiPIMS plasma promotes the formation of NPs twice larger than those obtained in dcMS mode.

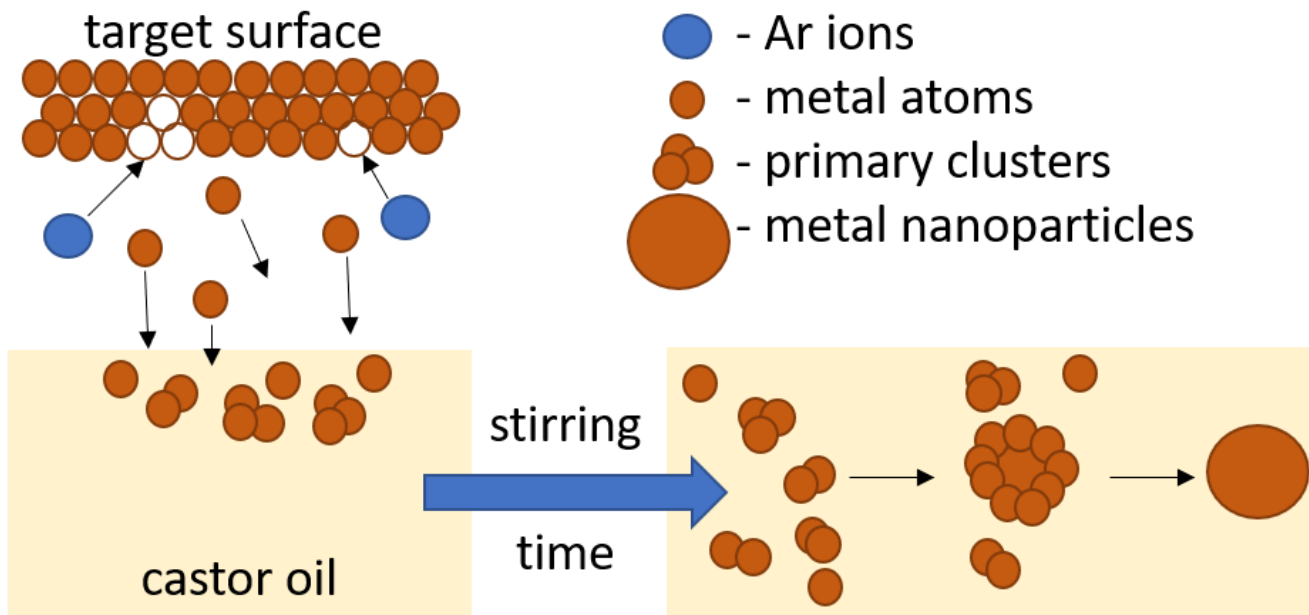
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References

[1] A. Sergievskaya, A. O'Reilly, A. Chauvin, J. Veselý, A. Panepinto, J. De Winter, D. Cornil, J. Cornil, and S. Konstantinidis, *Colloids Surfaces A Physicochem. Eng. Asp.* 615, 126286 (2021).

Scenario of Au-NPs formation in castor oil



Characterization of Au-NPs

