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Synthesis of Ag, Pt and AgPt nanoparticles by magnetron based gas aggregation source

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Depending on the size range of interest and on the required material involved, different techniques can be used to prepare metallic nanoparticles (NPs). This includes wet chemical techniques (colloidal, sol gel, water-in-oil) and physical vapor deposition (PVD) methods. Among PVD techniques, the gas-aggregation source (GAS) technique based on a planar magnetron, where the NPs are formed before their landing on the substrate, is attracting special interest. In this case, thermal post treatment is not required to form near-monodisperse NPs or to remove ligand. Such a source is already employed for the production of a wide variety of metal NPs of various sizes (2-10 nm) and shapes (nanorings or cubes). It could be coupled to vacuum deposition techniques to embede nanoparticles in matrix or to form quasi core-shell NPs [1].
In this contribution, we investigated the synthesis of Ag, Pt and AgPt NPs by the use of magnetron based gas aggregation source. Their size and their morphology were investigated by adjusting typical parameters as the power applied to the magnetron, the aggregation distance and the gas pressure, or by powering the magnetron cathode in high power impulse magnetron sputtering (HiPIMS) regime. Because NPs exhibit high degree of electrical charging, mass filtering has been also used to control the size of the NPs impinging onto the substrate. Moreover, we investigated the increase of the deposition rate already reported when oxygen is added to the working gas. Complementary measurements will be carried out by energy-resolved mass spectrometry in order to evidence the species produced during the target sputtering in O_2/Ar gas mixture and to explain the rise of deposition rate of the NPs in reactive sputtering.
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