Plasma Based Nanoparticle Synthesis: from Preparation to Function

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Abstract

The unique properties of nanoparticles (NPs) associated with their dimensions make them very attractive for the growing field of nanotechnology [1], [2]. The methods of their synthesis allowing a simple and reliable tuning of NP dimensions as well as chemical structure are in a high demand. Here, we focus on a plasma based approach for generation of different sorts of NPs. The focus is on a such called Gas Aggregation Source (GAS) which utilizes a magnetron sputtering at a relatively high pressure (~100 Pa) (see Figure 1) [3]. In this paper, we report on a recent progress in formation and deposition of NPs by the gas aggregation method. Examples range from noble (Au, Ag), through reactive (Al) to more advanced core-shell nanostructures [4]. The influence of experimental conditions on the physical, chemical and optical properties of NPs is discussed in details. However, despite intensive research over the years, the processes inside the GAS are not fully understood yet due to limited accessibility of the plasma volume. Here we propose an approach for *in-situ* monitoring of growth of metal NPs, exhibiting plasmon resonance, using UV-Vis spectroscopy. In addition to the fundamental studies of plasma based NP synthesis, we also show an example of functional applications of clusters and NPs for the UV sensors based on Ag-functionalized TiO_2 thin film (see Figure 2 and [5]).

References

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Figures

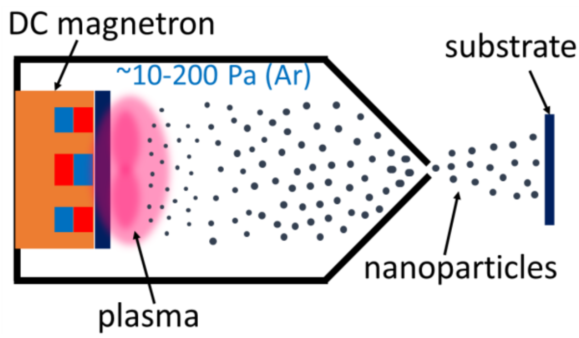

Figure 1. Schematic drawing of the gas aggregation source used for deposition of nanoparticles.

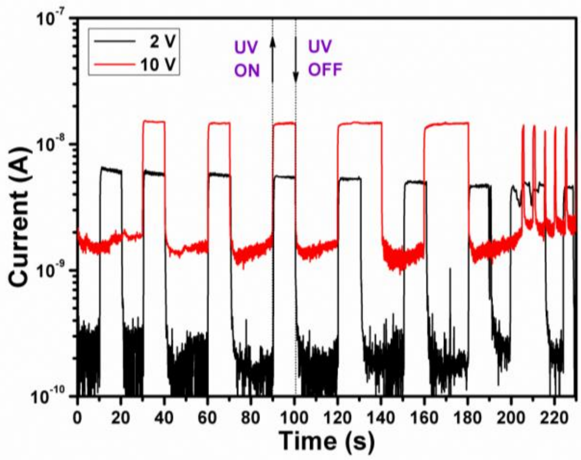

Figure 2. UV response of TiO_2 thin films with 15 nm with Ag-functionalized surface at two different applied bias voltages as 2 V and 10 V, respectively.