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# Functionalities of Silver Nanoparticles – how many and where to apply?

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The current tendency of compact design of devices requires integration of different functionalities in the same scheme. A way to respond to this demand is to apply multifunctional materials to assemble the device. Typically, the multifunctional materials are under the form of piled very thin layers or nanostructures with specific patterns. They offer the possibility for transition from material level of development to system level of applications. For example, to provide a dielectric layer with enlarged and well-controlled properties, one can use silver nanoparticles (AgNPs). The AgNPs are attractive due to their multifunctional properties and can address different applications.

This contribution reports on thin nanostructures based on AgNPs embedded in thin silica layers. Several applications of these multifunctional nanostructures are discussed. The optical properties of AgNPs are used to elaborate highly-performant plasmonic structures [1]. Charge injection and transport in dielectrics are demonstrated to be finely controlled via the AgNPs, thus providing solutions for MEMS RF switches and HVDC cables [2-4]. The critical for space applications electron emission from dielectrics under irradiation also can be controlled by incorporated in the dielectric AgNPs [5]. The catalytic properties of AgNPs appear extremely helpful to describe the role of metals in cosmic dust formation [6]. Last but not least, the AgNPs biocide properties are proved essential for fabrication of antimicrobial surfaces [7]. Combination of different AgNPs functionalities offers even larger scope of device fabrication.

**Keywords:** *silver nanoparticles, AgNPs, plasma processes, AgNPs multifunctionality*

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## Biography

Kremena MAKASHEVA is Senior Researcher at CNRS, Laboratory on Plasma and Conversion of Energy (LAPLACE), Toulouse, France. She obtained a Ph.D. degree on Plasma Physics from Sofia University, Bulgaria in 2002, for her work on surface wave sustained plasmas. Currently her research focus on reactive plasmas, and design, synthesis and characterization of nanostructures for biomedical, optical, electrical engineering and space applications. Multifunctionality of silver nanoparticles (AgNPs) is in the heart of her research. In 2015 she and her colleagues proposed AgNPs-based blocking layer to control charge transport in dielectrics. She regularly serves IEEE Nanotechnology Council (IEEE NTC) with different actions. Among others, she was IEEE NTC Vice-President for Technical Activities in 2020-2021.