GOLD-BLACK OPTIMIZATION AND CHARACTERIZATION

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Gold-black, a low density nanostructured film of gold particles has been an object of intense study since Vorobyev and Guo [1] used femtosecond laser ablation to generate nanostructured samples and showed that significant enhancement in light absorption by the material followed ablation. Such films find exquisite application as coatings for bolometers due to their strong absorption over a broad spectrum. Practical interest also arises from the possibility that nano-scale optoelectronic devices, optical pulse manipulation, and novel sensors can be derived from an understanding of the material's surface plasmon polaritons (SPP).

In this paper we present a two-level full factorial study for optimizing the absorption and adhesion of gold-black films. Variables included sample temperature, inert gas pressure, boat current, and saturation by polymer vapors. Characterization included reflectance and transmittance spectroscopy at 10 and 100 micron wavelengths to determine the absorbance. Film roughness and gold particle size distribution were also characterized by Scanning Electron Microscopy (SEM) (Figure 1). Near-field mapping using UV-photoemission electron microscopy (PEEM) allows for the observation of plasma wave propagation along nanostructure surfaces through the establishment of standing-wave patterns and/or "hot spots" centers. A specific goal of this work is to correlate the distribution of centers with the quality factor for IR absorption and its potential interpretation for device development.

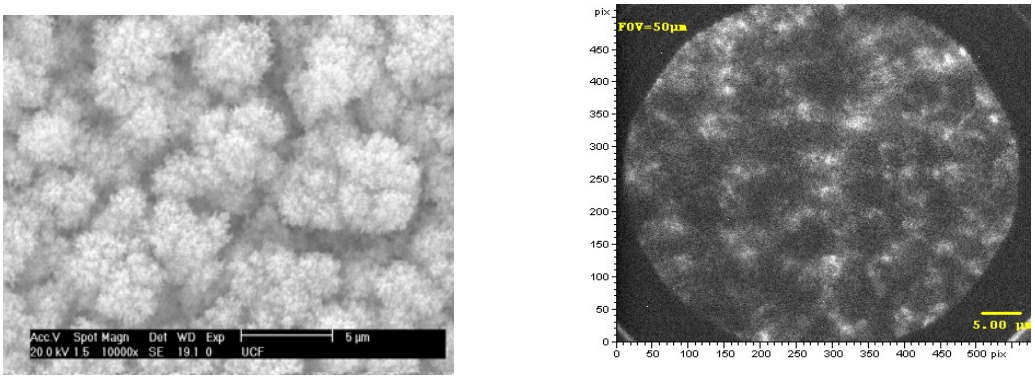

Figure 1. SEM (left) and UV-PEEM (right) images of typical gold-black nanostructured film.

[1] A. Y. Vorobyev and Chunlei Guo, Phys. Rev. B 72, 195422 (2005)