Synthesis of Carbon Nanostructures over Catalytically Active Nanoporous Gold and Cu Foams

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Presenting Author

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Abstract

Although nanoporous gold has been shown to be a promising catalytic material, few methods for preparing monolithic nanoporous Au foams, especially of metallically pure Au, exist. Here we present combustion synthesis of ultralow density, metallically pure gold nanofoams with bulk densities of less than 0.1 g/cm^3 and surface areas as high as 10.9 m^2/g. To our knowledge, these nanofoams represent one of the lowest density and highest surface area coherent forms of gold produced to date. The nanofoams were found to be highly catalytically active towards chemical vapor deposition synthesis of carbon nanotubes. For the first time, we report the growth of carbon nanotubes on Au nanoporous foams utilizing methane as the hydrocarbon source and demonstrating a novel method for a direct nanotube synthesis on conductive substrates. We found that by varying the synthesis conditions (hydrocarbon source and concentration), we were able to synthesize various 1D and 2D nanomaterials. Interestingly, Cu foams were found to be catalytically inactive in generation of any graphitic structures, under the same synthesis conditions as Au foams. We can tune and modify the morphological properties of the nanofoams, to generate graphitic nanostructures with specific electrical and mechanical properties.

Figures

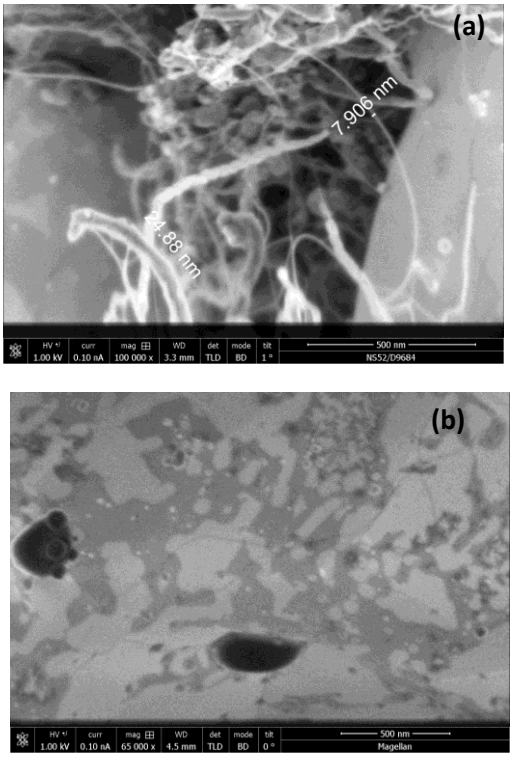

Figure 1: (a) SEM image of the nanotubes synthesized on the Au nanoporous foams using methane at 150 sccm. (b) Initial formation of graphitic structures over the Au nanofoams under methane flow of 40 sccm.