SAND2012-1927 C

SAND2012-1927C

Interferometrically Defined 3D Pyrolyzed-Carbon Sensors

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Interferometric lithography is capable of creating 3D structures with sub-micron length scales not possible using conventional lithography. Recently, we have demonstrated that we can convert these 2D/3D structures into amorphous sp2 and sp3 bonded carbon via pyrolysis in a reducing atmosphere [1]. The carbon can be further chemically converted to entirely sp2 bonded carbon. This paper details the use of these structures for two separate sensing applications: 1) A non-enzymatic glucose sensor with a 5 second response time and a detection limit of 10 mu-M glucose concentration; 2) A SERS substrate with large average SERS enhancement factor (7-9 orders of magnitude), uniform over macroscopic regions of the sample, in contrast to other SERS substrates which exhibit extremely localized "hot-spots." This paper will present detailed fabrication and characterization data of these materials.

Supported by the Laboratory Directed Research and Development program at Sandia National Laboratories. Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

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100 word abstract:

Using interferometric lithography 3D photoresist structures with sub-micron length scales are created and converted to 3D amorphous sp2 and sp3 bonded carbon via pyrolysis in a reducing atmosphere. The carbon can be further chemically converted to entirely sp2 bonded carbon. This paper details the use of these structures for two sensing applications: 1) A non-enzymatic glucose sensor with a 5 second response time and a detection limit of 10 mu-M glucose concentration; 2) A SERS substrate with large average SERS enhancement factor (7-9 orders of magnitude), uniform over macroscopic regions of the sample.