

Multi-laser Process for Fast Fabrication of Nanocrystalline (2020-034)

This multi-laser process integrates three fabrication steps to directly deliver sensors

Market Overview

Semiconducting metal oxide (SMO) gas sensors have been developed for a wide range of applications such as safety monitoring, environmental sensing, and medical diagnostics. 1D nanocrystalline SMO has shown great gas sensing response since their microstructure can facilitate surface reactions. However, the fabrication process of SMO gas sensors such as thermal evaporation, hydrothermal synthesis, or pulsed laser deposition are complicated and time consuming. The gas sensors market is projected to grow to \$1.4 billion by 2024, at a CAGR of 6.4% from 2019 to 2024. Clemson University researchers have developed a multi-laser process for the fast fabrication of nanocrystalline SMO gas sensors that integrates three laser processing technologies: circuit fabrication, SMO deposition and in situ post-annealing.

Technical Summary

This process is integrated with three laser processing technologies. Predesigned circuit patterns were fabricated on an Au-coated transparent glass substrate using a picosecond laser, which ablated the Au-coating from the back of the substrate to pattern the circuits. A picosecond laser transmits through the glass substrate at the gaps between two electrodes to ablate a SMO target to deposit the SMO nanonetwork layer on the fabricated circuits. The obtained SMO nanonetwork was in-situ post-annealed by a CO₂ laser to fine-tune the crystallinity.

Application

Fast Fabrication, Nanocrystalline SMO, Gas Sensors, Precise Deposition

Development Stage

Proof of Concept

Advantages

- Much faster fabrication time than other methods
- Precise deposition area control, no need for fine tuning
- Allows for flexible material properties control

App Type	Country	Serial No.	Patent No.	CURF Ref. No.	Inventors
N/A	United States	N/A	N/A	2020-034	Dr. Hai Xiao

About the Inventors



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Dr. Hai Xiao is the Samuel Lewis Bell Distinguished Professor in Electrical and Computer Engineering at Clemson University. Dr. Xiao received his Ph.D. from Virginia Polytechnic Institute and State University in 2002. Prior to coming to Clemson, he was an associate professor of electrical engineering at Missouri S&T. He is the recipient of the Office of Naval Research Young Investigator Program Award, R&D 100 Award, and the Virginia Tech Outstanding Achievement Award. His research interests focus on photonic and microwave sensors and instrumentation.

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