

## MATERIALS ENGINEERING

### SEMINAR

#### “Scalable Manufacturing of Metal Oxide-based Electrochemical Sensors via Laser Processing”

By

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Purdue MSE Preliminary Exam

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### ABSTRACT

Electrochemical sensors have gained attention in diverse areas of applications due to their high sensitivity, ease of use, compactness, and real-time signal. Most electrochemical sensors generate an electrical signal when the analyte of interest interacts with a specified recognition element on the electrode, such as aptamers, enzymes, and antigens/antibodies. Although these biomolecule-based electrochemical sensors show high selectivity and sensitivity, they often face several limitations, such as low stability and shelf-life, high cost, and complicated manufacturing approaches. In recent decades, nonbiological nanomaterials have gained attention as recognition elements in electrochemical sensors. Among various types of nanomaterials, metal oxides have been dramatically used for developing electrochemical sensors due to their natural abundance, distinctive electrochemical activity, and active surface area. Despite their well-understood characteristics, many functional metal oxide-based structures for electrochemical sensing require sophisticated multi-step chemical synthesis and expensive cleanroom manufacturing. To address those fabrication challenges, laser processing of metals can provide a scalable manufacturing alternative for developing functional micro/nanostructures directly on a metal surface, offering distinctive benefits, including energy and cost-efficient processing and fast and computer-controlled fabrication. Here we demonstrate a survey of laser-material interaction and how laser-assisted structural and chemical alterations could be employed for developing efficient micro/nano features which can function as recognition elements for electrochemical sensing. We will provide our preliminary results on the characterization and investigation of laser-induced nickel and copper oxide micro/nanostructures for glucose detection. This study includes a systematic evaluation of the effects of laser-processing conditions on the chemical structure and electrochemical efficiency of the developed copper surfaces. Finally, future work plans will be discussed, including the design and study of the laser-processed bimetallic structures in terms of physicochemical changes, improved mechanical properties, the possible synergic effect of metals, and their potential sensing capabilities.

**Date: Thursday, September 29, 2022**

**Time: 9:00am**

**Place: via WebEx <https://purdue.webex.com/join/rrahimi>**



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