Notice and Invitation
Oral Defense of Doctoral Dissertation
The Volgenau School of Engineering, George Mason University

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Graphene-Based Chemical Vapor Sensors for Electronic Nose Applications

Wednesday, April 13, 2016, 1:00pm – 3:00 PM
Showcase Room, Research Hall
All are invited to attend.

Committee
Dr. Qiliang Li, Chair
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Abstract

As chemical and biological sensors continue to be integrated into our daily lives, the demand for a highly dimensional, adaptable sensor array becomes increasingly important. Biologically inspired devices, such as the electronic nose (e-nose), have been around for more than two decades, but have had limited success due to high cost, large size, slow response, and limited selectivity. Many types of sensors have been utilized for e-nose applications, while 2D carbon-based graphene still remains unrealized in this application. Graphene holds much potential as a chemical sensing material due to its 2D structure, which provides a surface entirely exposed to its surrounding environment. In this configuration, every carbon atom in graphene is a surface atom, causing electron transport to be highly sensitive to adsorbed molecular species. Furthermore, the pure carbon makeup of graphene offers an attractive platform for surface modification to provide enhanced sensitivity and selectivity.

In this work, graphene is used as a chemical sensing material and its inherent broad selective nature is demonstrated by challenging the sensor against chemically diverse and similar compounds. Detailed analysis of the sensor response reveals relationships between the response kinetics and physiochemical properties of the sensed compounds. Sensor selectivity is extended by modification of the graphene surface, and lastly, a diverse range of polymers are used to modify an array of graphene sensors, which exhibit cross-reactive response behavior. This research demonstrates the first case of a cross-reactive, graphene-based chemical sensor array capable of being used in an e-nose for a broad range of applications.

A copy of this doctoral dissertation is on reserve at the Johnson Center Library.