

MATERIALS ENGINEERING SEMINAR

“Review on Metal-Nitride Vertically Aligned

Nanocomposites—Background, Current Status, and Future Directions”

Amirr Neal, MSE Preliminary Exam

Advisors: Professor Haiyan Wang

ABSTRACT

In recent years, vertically aligned nanocomposite (VAN) thin films have gained a lot of interest due to their unique optical properties and potential applications in the fields of microelectronics and photonic devices. An essential key to understanding the optical properties of VAN thin films is to explore the unique tuning and anisotropic nature of the optical properties, such as tuning of their relative permittivity properties. Through the self-assembly of the metallic and nitride components in the VAN pillar-in-matrix structure, it is interesting to note that one can achieve either isotropic or anisotropic optical structures, and possibly achieve the same or opposite signs of permittivity in the in-plane and out-of-plane directions. The optical properties of a couple of VAN systems that have been studied at length include oxide-oxide and oxide-metal VAN thin films, but relatively few studies have been focused on the optical properties of nitride-metal VAN systems. This is largely due to the limited demonstration of the nitride-metal nanocomposite systems in the literature. This presentation will focus on the background of plasmonic materials in general, the selection of nitride and metal plasmonic materials, the history and designs of VAN systems, and a discussion on the recent demonstrations of self-assembled metal–nitride VAN systems. Specifically, the tunability of metal-nitride systems will be discussed in the presentation, including the tuning achieved by the density of the metal pillar, pillar geometry, and thin film strain state. This presentation will also discuss the critical aspects of the field and their limitations and challenges. Future research directions along with preliminary results related to new nitride-metal VAN systems will also be discussed.

<https://purdue.webex.com/meet/hwang00>



School of Materials Engineering

**WEDNESDAY,
JANUARY 11, 2023
10:30AM**

**ARMS 1028
OR
WEBEX**