

## **Abstract**

**Non-Technical:** Youngstown State University (YSU) and its industrial partners are aggressively pursuing research in various materials including semiconductors, polymers, carbon nanotubes, ceramic-metallic composites and functional materials. A major requirement in processing these materials is the ability to etch desired patterns for devices. Funds from the Major Research Instrumentation program provide support for acquisition of an inductively-coupled plasma etching instrument. This instrument enables advances in fabricating efficient devices and helps to educate and train K-12, undergraduate & graduate students and high school science teachers. With the launch of YSU's new PhD program in Materials Science & Engineering, this instrument provides a pivotal training and research tool for use in at least 10 current research projects and provides training to over 30 PhD and MS graduate students and postdocs, and more than 300 undergraduate students per year as it is fully integrated into undergraduate and graduate curriculum at YSU. The PI and co-PIs actively participate in various outreach and minority-oriented programs such as the Youngstown Area Physics Alliance, Summer STEM for Minority Students and Project SEED which provide a platform for recruiting students from underrepresented groups to the research activities enabled by this instrument.

**Technical:** The multi-disciplinary materials-related research activities at YSU and its industrial partners include wide-bandgap semiconductors for high power electronic and short wavelength optoelectronic devices, multilayered polymeric systems for various photonic applications, carbon nanotubes for chemical & biological sensor applications, ceramic-metallic composites for military combat applications, and functional materials for micro-electro-mechanical systems. High density plasma etching offers a vital capability for fabricating the relevant functional device designs. The goal of this acquisition of the inductively-coupled plasma etching system is to support multidisciplinary research and education at YSU. Together with the existing state-of-the-art electron microscopy and lithography tools recently acquired at YSU, this equipment enables better understanding of the underlying structures of these materials in order to develop optoelectronic and nano/micro scale devices as well as elucidate the basic scientific processes governing the interaction of photons and charge carriers with nanometer size structures.