



**USAID**  
FROM THE AMERICAN PEOPLE



**Science, Technology, Research and Innovation for Development  
(STRIDE)**



**Plasma Cleaning: Development of Efficient Methods  
for Processing Microelectronic Device Surfaces**

**GRANTEE:** University of the Philippines Diliman (UPD)

**PRINCIPAL INVESTIGATOR:** Dr. Magdaleno R. Vasquez, Jr.

**US UNIVERSITY PARTNER:** University of Illinois at Urbana-Champaign (UIUC)

**GRANT PERIOD:** June 1, 2015, to March 31, 2017

**CONTRACT AMOUNT:** Php 4,300,000 (approximately USD91,500)

**The potentials of a plasma cleaning technology**

The Philippines continue to be a major player in the global microelectronics industry. However, a 2.5% decrease in export sales between April 2013 and April 2014 causes a major concern, not just for the local industry but also for the government, since electronic products account for almost half of the country's exports. The Philippine semiconductor manufacturing sector must continue to be innovative to remain competitive, ensure investors' confidence, and maintain its stature in the global market.

Value-adding processes such as plasma cleaning would make the Philippine electronics industry more attractive to investors. Plasma-based cleaning is a competitive candidate in surface treatment of micro- to nano-scale structures for microchip fabrication, semiconductor processing and packaging, optical industry applications, medical field devices, and many more because it allows removal of contaminants on the surface layer of the material without affecting the bulk properties of the material.

Realizing the potential of plasma cleaning technology, UPD, with support from USAID STRIDE, ventured to develop a dry, highly efficient, and environment-friendly cleaning process for the semiconductor industry for implementation in an "assembly-line" approach. This approach, as opposed to conventional batch processing, ensures and thereby improves product reliability and increases productivity.



*Research team visits the University of Illinois Urbana-Champaign with CPMI Director, Prof. David Ruzic*



*The first plasma etcher system in the Philippines*

The Plasma-Material Interactions Laboratory (PMIL) of UPD collaborated with Prof. David N. Ruzic and the Center for Plasma-Material Interactions (CPMI) of UIUC. During the initial stages of the project, the UPD research team visited CPMI and UIUC research facilities to gather insights and information on how to design plasma cleaning systems. Likewise, a tour of UIUC's partner industry, Starfire Industries, provided an avenue of learning laboratory-to-market strategies or how to commercialize technologies. Prof. Ruzic provided assistance by conducting workshops and lectures to students and industry professionals in the Philippines. He also served as one of the plenary speakers during the 1st International Symposium of the Vacuum Society of the Philippines, where he shared his latest research on plasma-surface interactions for the microelectronics industry.

### **Milestones**

During project implementation, the following were achieved:

- Fabrication of a plasma device that utilizes different gas admixtures such as argon, oxygen, and nitrogen to clean or etch surfaces, designed to hold 300 mm wafers and powered by a 13.56 MHz radio frequency power;
- Experimentation and examination of materials commonly used for microelectronic devices, such as copper and silicon, as well as polymeric surfaces such as polyethylene, polyimide, and polyvinyl chloride, and their properties of wettability, surface free energy, morphology, and adhesion strength with results indicating that plasma cleaning tuned surfaces of materials to desired properties; and
- Establishment of productive partnership or collaboration with UIUC.

### **Moving forward**

While Phase I focused on semiconductor process applications, alternative applications of the plasma device is being sought.