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SUNY Poly Researchers Awarded $1.5M by U.S. Department of Energy's Vehicle Technology Office for Highly Efficient and Reliable Power Electronics Devices

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Dr. Shahedipour-Sandvik Receives Additional, Separate National Science Foundation Grant of $255,000 for Research into More Effective Materials for Enhancing Semiconductor Energy Efficiency

Dr. Sung Receives Additional, Separate Office of Naval Research Grant of $250,000 to Develop
High Voltage Power Devices on Silicon Carbide to Meet U.S. Navy and Commercial Needs

ALBANY, NY – SUNY Polytechnic Institute (SUNY Poly) announced today that Interim Vice President of Research Advancement and Graduate Studies Dr. Shadi Shahedipour-Sandvik and Associate Professor of Nanoengineering Dr. Woongje Sung have been selected to receive $1,500,000 in total federal funding from the U.S. Department of Energy's Vehicle Technology Office (VTO) for the development of 1200V silicon carbide metal-oxide-silicon-field-effect-transistors (MOSFET), and for reliability studies of Aluminum Gallium Nitride-based high electron mobility transistors (HEMT), the switch components of power electronic chips, which are superior to their silicon–based counterpart in areas such as cost, performance, and reliability. This could lead to highly efficient and reliable power electronics for electric drive trains for a range of applications, including improved electric vehicles.

"On behalf of SUNY Poly, I congratulate Dr. Shahedipour-Sandvik and Dr. Sung for this award enabling advanced power electronics research, which can have a significant impact on next-generation applications, including enhancing clean transportation capabilities," said SUNY Poly Interim President Dr. Grace Wang. "This VTO grant showcases the in-depth expertise of our faculty, that, when combined with SUNY Poly's globally recognized research capabilities, drives advancements that can strengthen our nation's energy independence and benefit our high-tech economy. I am also excited that a number of undergraduate and graduate students will gain first-hand experience in this research area. In addition, I commend both Drs. Shahedipour-Sandvik and Sung for their additional and separate grants from the National Science Foundation and Office of Naval Research, respectively, which are once again testaments to our innovation-focused faculty who are addressing a number of critical, unmet technological, commercial, and military needs."

The SUNY Poly VTO award will support research efforts through the new "Electric Drive Technologies Consortium," of which SUNY Poly is one of the 10 founding University members; the consortium is supported by the Vehicle Technology Office and Department of Energy. The

grant will also provide an immersive research experience for a number of SUNY Poly graduate students who will be able to participate in the project, in addition to several undergraduate students who will also be encouraged to take part in various aspects of the effort, including design, fabrication, characterization, and analysis of the SiC power devices.

More specifically, the SUNY Poly researchers will demonstrate a highly reliable wide bandgap (WBG) aluminum gallium nitride/gallium nitride (AlGaN/GaN) HEMT-based power device. Making use of the AlGaN/GaN semiconductor material's properties to enable higher performance for HEMT on GaN as compared to the state-of-the-art HEMT on other substrates, such as sapphire, the device will have extremely high levels of performance at certain frequencies with low noise, making it ideal for high-speed, high frequency applications.

"I am excited to partner on this grant as we leverage SUNY Poly's advanced research capabilities to drive next-generation power device technologies based on cutting-edge materials and processes, and I am grateful to the Department of Energy's Vehicle Technology Office for this award, which will utilize our unique epitaxial growth system and baseline process to fabricate HEMT on GaN," said Dr. Shahedipour-Sandvik. "I am also extremely grateful to the National Science Foundation for the additional grant which will underpin research with our partnering institution into novel materials for more energy efficient lighting and computing capabilities, which are critical for the future because of the vast energy consumption resulting from current, less efficient computer chips. We look forward to these exciting research opportunities not only because of what they can lead to, but also because they will provide an excellent hands-on lab experience which can act as a launching pad for a number of our SUNY Poly graduate and undergraduate students."

"I would like to thank the VTO/DoE for recognizing our power electronics research in which we will design the device and process flow before evaluating the performance and reliability of the silicon carbide (SiC) devices at SUNY Poly's state-of-the-art facilities," said Dr. Sung. "In addition to this project serving as an excellent educational opportunity for SUNY Poly students, I am also honored to have received a separate grant from the Office of Naval Research and look forward to working with our partners to develop high-voltage SiC power devices for a number of critical defense and commercial applications."

Drs. Shahedipour-Sandvik and Sung have also received additional research funding for the following separate projects:

Dr. Shahedipour-Sandvik - $255,000 for the Development of More Energy Efficient Semiconductor Materials

In addition, Dr. Shahedipour-Sandvik recently received a separate $255,000 award from the National Science Foundation to research novel efficient p-type nitride materials, the materials that are used to create more energy efficient semiconductors for advanced solid-state lighting and computing capabilities. The research under this grant will form the basis of a graduate student's thesis research as well as the Capstone research of an undergraduate student and will be conducted in collaboration with Virginia Commonwealth University.

Dr. Sung - $250,000 for the Development of High Voltage Power Devices on Silicon Carbide

Dr. Sung also received another separate $250,000 research award from the Office of Naval Research for the development of high voltage (12kV) power devices on SiC, in collaboration with The Ohio State University, the U.S. Naval Research Laboratory, and CoolCAD Electronics, LLC. These 12 kV SiC devices could address a number of U.S. Navy needs, such as for Medium Voltage Distribution on more electric ships, as well as provide direct power for critical needs during a mission and the degaussing of ships, rail guns, and solid state transformers, for example.

This research could also lead to a number of commercial applications, such as variable speed drives for megawatt (MW) class electric motors, 13.8 kV distribution grid equipment, the incorporation of renewables on the distribution grid, and High Voltage DC (HVDC) transmission, among others. Dr. Sung's research team will design the device and process flow. After the fabrication process is complete, they will evaluate the performance and reliability of the SiC devices at SUNY Poly's Albany campus, where SUNY Poly graduate and undergraduate students will be able to participate in their design, fabrication, characterization, and analysis.