2021F_07_HAN

Application Title: Improving 3D Micro/Nanoscale Structure Fabrication Capabilities at the AggieFab Nanofabrication Facility

Lead contact for RDF Application:

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Key Participating Units (in alphabetical order):

Departments: Aerospace Engineering, Biology, Biomedical Engineering, Chemical Engineering, Chemistry, Electrical and Computer Engineering, Mechanical Engineering, Microbial Pathogenesis and Microbiology, Petroleum Engineering, Physics, Plant Pathology and Microbiology, Veterinary Pathobiology

Colleges: Agriculture and Life Sciences, Engineering, Health Science Center, Science, Veterinary Medicine and Biomedical Sciences

RDF Amount Requested ($): $1,658,017

Executive Summary

The application is to improve the three-dimensional (3D) micro/nanoscale structure fabrication capabilities at the AggieFab Nanofabrication Facility (aggiefab.tamu.edu), a shared micro/nanoscale fabrication cleanroom user facility. During FY20-21, 41 PIs and 72 users from 13 departments and 3 colleges within TAMU used the facility. In addition, 1 national laboratory and 5 companies utilized the facility. We are requesting equipment to offer two new capabilities. **(1)** Provide new capabilities to create 3D micro/nanoscale structures, especially for sensor, actuator and biomedical microdevices in addition to next-generation semiconductor/photonic/optics/quantum devices. The fabrication of these devices will be enabled by a **Samco RIE-800iPB deep reactive ion etcher** that can generate high-aspect-ratio micro/nanoscale structures and a **Tousimis 938 Series C supercritical point dryer** that can release the fabricated micro/nanoscale structure without stiction of the structure. **(2)** Provide new capabilities for micro/nanoscale patterning that can create patterns on large substrates (up to 8-inch substrate size). This will be enabled by a **Heidelberg MLA150** system. Both capabilities are broadly utilizable for both the current users as well as for potential future users, as the capability to create diverse ranges of micro/nanoscale structures is the basis for micro/nanoscale fabrication processes. These two instruments/capabilities were identified as critical equipment needs by the users through surveys we conducted. The two capabilities proposed herein exist in almost all major nanofabrication cleanroom facilities in the nation, which is a clear indicator that these capabilities are essential to broad application areas. The enhanced capabilities will immediately benefit the ~20 faculty specifically named in the project description section, but importantly, we also expect that these will be utilized by almost all current uses of the facility. The ability to create new structures and devices as well as develop new fabrication methods are expected to provide PIs far more enhanced capabilities in the pursuit of federal/industry funding that would not be possible if such cutting-edge structures/devices/processes cannot be fabricated. The research themes enabled by this investment, such as energy, biotechnology, biomedical/health applications, advanced manufacturing, semiconductor, and quantum, to name a few, are all emerging areas that the federal government is extensively investing in. We also anticipate interacting much more extensively with industry stakeholders. The AggieFab also provides a place for interdisciplinary activities, as researchers from different departments naturally interact in the open-space nature of the cleanroom facility. Finally, AggieFab has experienced tremendous growth in terms of the number of users and usage (counted in $$ spent as user fees) in the past 5 years. We expect that the new capabilities will further increase this trend.