Research Development Fund – Fall 2015 Application

Application Title: Enhancing *in situ* Microscopy for Nanoscience and Nanotechnology at TAMU

Lead contact(s):

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Department(s): BICH**,** BIOL, CHEM, MSEN

Key Participating Units: COS, COE/TEES, Geosciences, AgriLife, HSC

Request Amount: $2,152,546

Executive summary of the intended proposal. This proposal is aimed at addressing core infrastructure needs for enhancing *in situ* high resolution microscopy tools for nanoscience and nanotechnology at TAMU. Recent investments have significantly advanced our electron microscopy capabilities on campus, however key missing elements to our materials analysis suite include *in situ* tools for examining the local mechanical/structural/chemical properties of materials on the nanoscale, and down to the atomic scale. These include tools for probing changes that occur in materials under strain, as well as tools for *in situ* nanoscale IR spectroscopy. Here faculty across the COE and COS are seeking 3 *in situ* tools for nanoindentation and tensile testing, to be outfitted across two SEMs and one high resolution TEM, to provide the ability to examine on the nano/atomic scale simultaneous structural and mechanical changes in materials under strain. These types of measurements are key to addressing new materials design in numerous areas from corrosion to biomedical implants, to engines, to the aerospace industry, and would strongly support recent new faculty hires in MEEN, PETE, CHEM and MSEN. We have significant research expertise in these areas, and the acquisition of these tools will elevate the researchers at TAMU to the top level. Moreover, these capabilities are not available at nearby institutions, making these resources regionally important. Other tools that have been emerging as an increased need at TAMU, include enhanced facilities for high spatial resolution chemical imaging tools. Our materials and life sciences researchers would greatly benefit from a combined IR-AFM system for concomitant nanoscale structural and chemical mapping in non-vacuum environments. Here we are proposing the acquisition an IR-AFM system which will be placed in the new MCF scanning probe microscopy suite. Alongside these enhancements, additional core infrastructure upgrades are also requested, specifically with an eye toward updating our EM user interfaces, and strengthening our EM sample preparation. Here, *in situ* and cryo-EM preparative and imaging capabilities (along with an experienced technician) are essential needs for high end characterization of nanostructures for soft materials being sought by our users. The requested instruments and staffing will be integrated into the existing MCF and MIC cores, whereby the existing facilities infrastructure is already in place to ensure apt access and maintenance of these tools. Between these two facilities, more than 500 users are supported on campus along with a host of outside industrial users, making these capabilities available to a wide audience across the COE, COS, Geosciences, Agrilife and the HSC. A subset of these include the primary faculty on whose behalf this overall request is being submitted, and those key faculty are listed in each section. Our overall request for the instrumentation and upgrades are budgeted across 3-years with the request distributed in order of priority to ensure the introduction of these tools in a logical sequence.