2020S_BULLARD

Research Development Fund – FALL 2019 Application Template
SUBMISSION DEADLINE: ***Monday – March 30, 2020 at 12 noon CDT*** **to rdf@tamu.edu**

*****Applications that exceed page limits for any section or do not follow template will not be reviewed*****

Application Title: *4D Characterization of Complex Porous and Granular Media*

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Key Participating Units: Materials Characterization Facility (MCF), Center for Infrastructure Renewal (CIR), COE/TEES, College of Science, College of Geosciences, Agriculture and Life Sciences, College of Veterinary Medicine

Anticipated Request Amount ($): $1.29M

Executive summary of this application to utilize Research Development Funds:

This proposal is addressing core needs for enhancing the measurement capabilities for research related to granular and porous media. These medias are key components in many areas of processing, manufacturing, catalysis, construction, medicine, and geosciences. The ability to accurately characterize their complex properties is therefore important to the success of the Manufacturing Initiative at TAMU, the Texas A&M Space Alliance, and to meeting critical national needs in the areas of energy, infrastructure, and the environment, and healthcare. Recent investments, including those from the RDF fund in 2015, 2016, and 2019 have significantly advanced the characterization capabilities at the Materials Characterization Facility (MCF). This includes recent investments for characterization of powders, such as a particle size analyzer and surface area analyzer (RDF2019). Nevertheless, our current facilities are still missing a capability that is crucial for characterizing the microstructure and properties of complex—and frequently evolving—granular and porous media that are used in catalysis, metal and ceramic processing, construction, extraction, mining, bone replacement, and maxillofacial surgery. Faculty across the Colleges of Agriculture and Life Sciences, Engineering, Geosciences, Science, and Veterinary Medicine and are seeking a state-of-the-art high-resolution X-ray microscope that will enable *four-dimensional* (4D) measurements of granular and porous structures, including (1) sub-micrometer spatial resolution, (2) non-destructive tracking of 3D structural changes as a function of time under controlled environmental conditions, (3) digital characterization and reconstruction of individual phases and particles within complex structures, and (4) acquisition and curation of digital twins for components and manufacturing processes, or biomedical tissue samples.

The proposed instrument is essential for quantifying the properties and performance of complex porous and granular media across a wide spectrum of natural and engineering interest including chemical catalyst beds, filters, terrestrial, lunar, and Martian soils and rocks, batteries, cements, additively manufactured components, composites, and biological tissues. In addition, the instrument would strongly support recent new faculty hires across the campus by attracting top experts in the area of materials processing and manufacturing, materials science and engineering, geology and biomedical sciences. TAMU researchers already have significant expertise in these areas, and the acquisition of this instrument will further elevate their capabilities and attract the best new faculty candidates.