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OVERVIEW

Tuskegee University (TU) is a national, independent, and state-related institution of higher learning, located in the State of Alabama. TU has distinctive strengths in the sciences, architecture, business, engineering, health, and other professions. The College of Engineering offers four undergraduate programs in Aerospace Science, Chemical, Electrical, and Mechanical Engineering that are accredited by the Accreditation Board for Engineering and Technology (ABET). Our Aerospace Engineering is the only ABET-accredited program at an HBCU. Graduate programs are available at the Masters level in Chemical, Electrical, and Mechanical Engineering. A Doctor of Philosophy and a Master are also offered in Materials Science and Engineering (MSEG). TU produces the most African American PhDs in MSEG, serving the academic, federal and industry arenas.

RESEARCH CAPABILITIES

Aerospace Engineering: experimental aerodynamics, computational fluid dynamics vortex-dominated flows, flight simulation, configuration aerodynamics, human interface, small satellites, spacecraft dynamics, autonomous robotics, turbulence and fluid measurements, aircraft engine measurements.

Chemical: CO₂ capture and storage, membrane separation, physico-chemical water and biological waste water treatment, microfluidics for materials processing, pulp and paper process engineering, biodiesel from vegetable oils with honeycomb monolithic catalysts, nanocomposites of graphene aerogel for energy storage applications.

Electrical and Computer Engineering: power systems, multiresolution signal/image analysis, target detection and tracking, artificial intelligence in control systems, big data, machine learning, micro and nanofabrication, computational intelligence, portable sensors, data analytics, security and privacy, wireless networks, cyber physical systems, portable energy storage, advanced materials for photonics.

Mechanical Engineering: electric propulsion, fracture and failure analysis, corrosion, additive manufacturing, degradation of materials under extreme conditions, processing and characterization of nano-phased composites, fuel cell, flow diagnostics, microfluidic actuator design, rail steel repair, flood damage mitigation, energy efficient nanostructured cementitious compounds.

Materials Science & Engineering: thermoset polymers, static and dynamic characterization, fiber reinforced composites, nanocomposites, foam core sandwich, nondestructive evaluation, durability of nano-phased polymeric composites, nano biomaterials, polymer composites, carbon materials, high temperature polymeric materials, computational mechanics, experimental and finite element analysis.

PAST PERFORMANCE (examples)

Aerospace: NSF funded major instrumentation awards for experimental measurements of vortex dominated flows e.g. wing-body juncture flow, wake three-dimensionality of three-dimensional bluff

bodies; computational fluid dynamics analysis of cavity flows; collision avoidance of unmanned aircraft system in a limited airspace; **ARL** on terrain visualization training; **NASA** on Above-Real-Time-Training.

Chemical: **DOE** on synthesis and electrochemical characterization of graphene-metal/metal oxide nanocomposites; optimization of Fenton's oxidation conditions for removal of chrysene in aqueous solutions; biochar production and its application to remove Cr (VI) and ammonium-nitrogen from aqueous solution; identification of novel corrosion inhibitors; detection of total organic carbon in crude oil; GC/MS profiling of hopane biomarkers in crude oil; alternative methods for CO₂ capture from flue gas.

Electrical: **DOD** on high efficiency flexible solar cells and energy storage devices. **NASA** on micro shutter design for the James Webb Space telescope and analog synthesis of mixed-signal application specific integrated circuits for flight electronics. **DHS** on portable sensors for the detection of biological pathogens and chemicals. **NSF** on advanced materials and their growth methods for optoelectronics.

Mechanical: **DOD** on hypervelocity impacts of aerospace materials; nanostructured coatings; composite materials. **DOE** on the effect of harsh environments on the mechanical integrity of epoxy and polyurethane systems. **Raytheon Co.** on test and validation of connector hardware for use in extreme environments.

FRA on surface defects welding repair of railheads. **Nucor Steel** on effect of zinc galvanization on the fracture behavior of structural steel. **Boeing Co.** on mitigation of tin whisker growth using nanostructured conformal coatings. **NSF** on laser and ion beam bombardment of high Z materials; dislocation dynamics.

Materials Science & Engineering: **DOD** on UV studies of fiber reinforced nanoclay-epoxy composites; durability and life prediction; sandwich composites; high temperature polymeric composites. **NSF** on synthesis of graphene/Ag hybrid nanoparticles for multifunctional carbon fiber composites; impact properties of carbon nanofibers integrated carbon fiber/epoxy hybrid composites; advanced green composites.

FACILITIES

Aerospace: 2ft x 3ft low speed wind tunnel, 32-channel solid state pressure measurement system, 6-component pyramidal balance, 15in x 20in water tunnel, volumetric particle image velocimetry system, UAV manufacturing facility (CNC foam hot-wire-cutter/mill, 3D printer, vacuum bagging), electric propulsion (motor, propeller, battery) test facility, CubeSat magnetic characterization, 4-node dual core cluster computer.

Chemical: total organic carbon and nitrogen analyzer (Shimadzu TOC-L), freeze dryer, Zeta potential analyzer, Shimadzu GC-MS equipped with autosampler (GC-MS Q2010), FTIR, graphite furnace atomic absorption spectrophotometer, HACH spectrophotometer (Model: DR-2800), SPEX 8000M mixer/mill, Cilas particle size analyzer (Model: CILAS-1064)

Electrical: Microelectronics Lab with cleanroom facility for semiconductor thin film processes, bulk and surface micro-machining, micro- and nano-fabrication, a characterization facility for electrical, optical, and surface studies.

Mechanical: additive manufacturing lab, flow diagnostic lab, Nucor Education & Research Center of Excellence, fracture and failure analysis lab, corrosion testing equipment, environmental aging chambers, scanning and atomic force microscopes, robotics and mechatronics lab, welding research lab, etc.

Materials Science & Engineering: composite materials processing, nano and bio nano materials processing, morphological characterization, mechanical and thermal characterization, nondestructive evaluation, polymer characterization capabilities: DMA, DSC, TGA, DTA, FTIR, rheology, Raman spectroscopy, NDE capability: ultrasonic and thermography, 3D printing of films, particle size analyzer.