

South Dakota NASA EPSCoR 2010 Major Research Grant
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South Dakota investigator(s) and affiliation	Project title	NASA funds	NASA and other collaborations
PI: Edward Duke, SDSM&T Co-I's: Paul May, USD; Lifeng Zhang, SDSM&T; Hao Fong, SDSM&T; Brian Logue, SDSU Co-I/Science PI: Chaoyang Jiang, USD	Enhanced Raman Detection of Minerals, Microbes, and Biomarkers through the Development of Advanced Plasmonic Nanomaterials	\$750,000	Bin Chen, Advanced Studies Laboratory, NASA Ames Research Center; Christopher P. McKay, Space Science Division, NASA Ames Research Center; Yuyu Sun, Biomedical Engineering, USD; Dongming Mei, Department of Physics, USD; Mary T. Berry, Department of Chemistry, USD; King Wang, Vice President of Materials Technologies, Agiltron Inc.; Subodh K. Singh, Sinte Gleska University

Abstract

Enhanced Raman Detection of Minerals, Microbes, and Biomarkers through the Development of Advanced Plasmonic Nanomaterials

This project will develop advanced plasmonic nanomaterials as substrates for enhanced Raman detection of minerals, microbes, and biomarkers. The scientific merits of this proposal arise from recent theoretical and experimental advancements in plasmonic nanomaterials, namely, that Surface Enhanced Raman Scattering (SERS) based on metallic nanostructures can provide substantially detailed and valuable molecular information. This project directly supports the design of compact chemical and biochemical detectors for NASA's planetary exploration by providing Raman-active nanostructured materials. The project will focus on the synthesis, surface modification, and characterization of porous silver nanotube networks (PSNNs). Furthermore, SERS detection of minerals, microbes, and biomarkers with the newly developed PSNNs will be systematically investigated, and the structures of PSNNs will be optimized for the highest sensitivity. This proposal describes an integrated plan to (1) develop PSNNs with superior sensitivities for SERS detection of chemical and biochemical compounds of interest to NASA, (2) establish a multi-institutional research team in South Dakota focused on chemical sensing utilizing advanced plasmonic nanomaterials, (3) strengthen collaborations with scientists at the NASA Ames Research Center (ARC) to develop and evaluate innovative nanomaterials based on PSNNs for planetary exploration, (4) enhance multi-level education on plasmonic nanomaterials and chemical sensing for undergraduate and graduate students, including Native American students, and (5) collaborate with industrial partners to promote economic development activities. This project will be carried out through collaboration of faculty members (from three research universities and one tribal college in South Dakota), research scientists, graduate and undergraduate students, and industrial partners. It will also be monitored by scientists in NASA ARC for both research and education activities. The successful outcomes of this project include the establishment of a multi-institutional research cluster, the development of advanced plasmonic nanomaterials of PSNNs, the education of students, and the promotion of economic development activities.