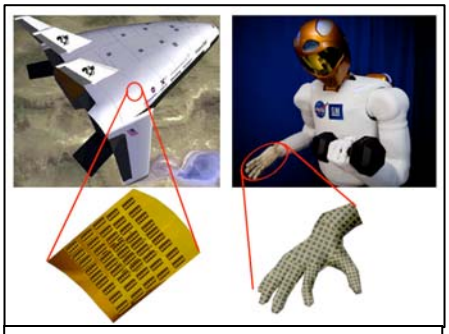
SD NASA EPSCoR 2012 Major Research Grant
(Approved for funding Jan. 1, 2013 - Dec. 31, 2015)

South Dakota investigator(s) and affiliation	Project title	Funding summary	NASA and other partners
Administrative PI: **Edward F. Duke**, SDSM&T, Director SD NASA EPSCoR Science PI: **Zhengtao Zhu**, SDSMT Co-I's at SDSMT: **Phil Ahrenkiel, Steve Smith, Haeyeon Yang** Co-I/Institutional PI at SDSU: **Qiquan Qiao** Co-I's at SDSU: **David Galipeau, Cheng Zhang**	Flexible Electronics for Space Applications: Development of New Materials and Device Processing Technologies	$750,000 (NASA) $375,000 (Match)	Glenn Research Center, Langley Research Center, Jet Propulsion Laboratory, Sinte Gleska University, Argonne National Laboratory, Semprius, Inc. (Durham, NC)

Project Summary
(Funded South Dakota NASA EPSCoR 2012 Major Research Project)

Flexible Electronics for Space Applications: Development of New Materials and Device Processing Technologies

The goal of this project is to develop new materials and technologies that enable light-weight, conformable, flexible, and stretchable electronic devices and sensors for space applications. The project is directly related to the mission of the Exploration Technology Development Program within NASA's Exploration Systems Mission Directorate, which is to develop long-range technologies to enable human exploration beyond Earth orbit. To achieve this goal, a multidisciplinary team of materials scientists, semiconductor physicists, chemists, and electrical engineers from the South Dakota School of Mines and Technology and South Dakota State University, as well as NASA and industry partners, will make a collaborative effort to address the challenges in flexible electronics based on inorganic and organic materials for applications relevant to NASA missions. The specific objectives of the project include: (1) Fabricating inorganic semiconductor micro-/nano-structures on flexible substrates by combining substrate patterning and printing with advanced semiconductor growth; (2) Synthesizing high-mobility organic semiconductors via polymer and material chemistry; (3) Developing high temperature flexible substrates and high-k dielectrics; and (4) Transferring the photovoltaic cells, transistors, and sensors onto flexible substrates. The team will work toward these research goals in collaboration with, the NASA Glenn Research Center, Jet Propulsion Laboratory and Langley Research Center. In addition to the research goals, another major objective of the project is to enhance South Dakota's research infrastructure for flexible electronic technologies, and to support state-sponsored PhD programs in Nanoscience and Nanoengineering, and Electrical Engineering, thereby leveraging NASA investments in student training and recruitment. The project will build infrastructure and expertise in flexible electronic materials and device research, making South Dakota researchers more competitive for follow-on funding, and creating economic development opportunities through industrial partnerships.



Left: Arrays of large-area and conformable high-efficency solar cells and strain sensors integrated on a spaceship; **Right**: stretchable and flexible sensors and transistors (artifical skin) on the hand of a spacesuit. (Images of X-33 aircraft and Humanoid Robot are from NASA website. Image of artifical skin from UC Berkeley website.)

NASA received a total of 57 proposals for this solicitation. From these, 17 were recommended for funding. The proposal from Dr. Zhu and his colleagues earned very good reviews. As stated in the panel summary: "The reviews are excellent. Flexible electronics are the next 'big wave' at NASA." The panel also noted the significant "potential NASA spinoff technology."

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