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Award Abstract #1121252

Next-Generation Materials for Plasmonics and Spintronics

NSF Org:	DMR Division Of Materials Research
Initial Amendment Date:	September 7, 2011
Latest Amendment Date:	June 28, 2017
Award Number:	1121252
Award Instrument:	Cooperative Agreement
Program Manager:	Daniele Finotello DMR Division Of Materials Research MPS Direct For Mathematical & Physical Scien
Start Date:	September 15, 2011
End Date:	August 31, 2018 (Estimated)
Awarded Amount to Date:	$12,250,000.00
Investigator(s):	Ajay Nahata nahata@ece.utah.edu (Principal Investigator) Anil Virkar (Former Principal Investigator) Steven Blair (Co-Principal Investigator) Ashutosh Tiwari (Co-Principal Investigator) Michael Bartl (Former Co-Principal Investigator) Ajay Nahata (Former Co-Principal Investigator) Brian Saam (Former Co-Principal Investigator)
Sponsor:	University of Utah 75 S 2000 E SALT LAKE CITY, UT 84112-8930 (801)581-6903
NSF Program(s):	MATERIALS RSCH SCI & ENG CENT
Program Reference Code(s):	1711, 6863, 7237, 7644, 8990, 9161, 9177, 9178, 9250, 9251, AMPP, SMET
Program Element Code(s):	1735

ABSTRACT

Abstract:

The mission of the University of Utah's Center of Excellence for Materials Research and Innovation (Utah CEMRI*) on Next Generation Materials for Plasmonics and Organic Spintronics is to foster interdisciplinary basic research on new materials, develop the underlying theoretical and experimental science, train the next generation of scientists, create curiosity and excitement in Science, Math, and Engineering among the nation's youth, transmit the knowledge to the broadest possible segments of our society, and lay the foundation of the next generation science and technology that will revolutionize society. This will be accomplished through a number of research, educational and outreach programs.

The Utah CEMRI includes two interdisciplinary research groups (IRGs), namely Plasmonic Metamaterials from the Terahertz to the Ultraviolet (IRG 1), and Organic Spintronics (IRG 2). IRG 1 will focus on understanding and exploiting the properties of surface plasmon polaritons in artificially structured materials (metamaterials) across a broad range of the electromagnetic spectrum. The goals of IRG 1 include creatingnew optical tools, materials and device architectures in the

THz spectral range, demonstrating the applicability of magneto-plasmons to improve spin injection into organic semiconductors and developing capabilities for plasmon-enhanced UV resonant optical spectroscopies. IRG 2 will focus on understanding and manipulating spin excitations in several different spin-related organic devices, including organic spin-valves, spin-organic light emitting diodes, and spin-enhanced organic photovoltaics for solar energy harvesting. Using fundamental electrical, optical and magnetic studies, the primary goal of this group is to enhance basic understanding of spin interactions in organic materials, including hyperfine, spin-orbit and exchange. These studies will be used to develop spin-based organic light emitting diodes, which have applications in magnetic memory and displays, and low-cost organic photovoltaic cells with enhanced conversion efficiency for solar energy. Seed projects will be funded through a competitive peer review process with a goal of leading the Center into emerging transformative research areas and forming the basis of a new future IRG. All research projects will be regularly reviewed on a competitive basis to maintain high levels of scientific excellence, collaboration and productivity. In order to expand the scope of research and broaden the research perspectives of graduate students and post-docs, Utah CEMRI members will actively engage in substantive collaborations with universities, industry and national labs in the US and abroad. The results of research will be published in high quality, high impact refereed journals.

An important role of the Utah CEMRI is to broaden participation in the research endeavor. This involves actively working to increase the diversity among students, post-docs and faculty members, with increased participation from members of under-represented groups. The Utah CEMRI will implement educational and outreach activities designed to impact K-12 students, teachers (RET), undergraduate students (REU), underrepresented groups, and broad segments of society through active participation of all center members. These activities include an annual Science Olympiad, Discover Engineering program for high school students, Partner School Program for K-12 students, Hi-GEAR (Girls Engineering Abilities Realized) summer camp for female high school students, ACCESS program to encourage women to pursue Science, and REU and RET programs. All major diversity, education, and outreach programs will be regularly assessed to ensure their efficacy and impact.

*An NSF Materials Research Science and Engineering Center (MRSEC)

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