



Sandia National Laboratories



**U.S. DEPARTMENT OF
ENERGY**

Project Accomplishment Summary

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.



Sandia National Laboratories

Operated for the U.S. Department of Energy by
Sandia Corporation
Albuquerque, New Mexico

PROJECT ACCOMPLISHMENTS SUMMARY

Cooperative Research and Development Agreement (#1573.105)

between **Sandia National Labs** and **Lockheed Martin Corporation**

Note: This Project Accomplishments Summary will serve to meet the requirements for a final abstract and final report as specified in Article XI of the CRADA.

Title: Structurally Doped Graphenoid Materials: Electronic and Optical Testing

Final Abstract:

The purpose of this project was to measure the electronic and optoelectronic properties of graphene device devices provided by Lockheed-Martin. We found that the devices had excellent electronic properties but showed little photoresponse.

Background:

Sandia and Lockheed-Martin partnered on this project because LM had the graphene devices and Sandia had unique electronic and optoelectronic testing capabilities. The types of graphene devices that LM provided had never been fabricated before and had never been tested for optoelectronic response.

Description:

The purpose of this project was to assess the promise of a new type of graphene device for optoelectronics. The device provided by LM was fabricated by depositing graphene on an insulating substrate, patterning it by etching, and then depositing top contacts using e-beam lithography. The patterning of the graphene was such that a ballistic rectifier response could be expected. Devices were tested at Sandia using state-of-the-art electronic and optoelectronic characterization capabilities. Different probe stations were used to measure the current-voltage characteristics. In addition, a scanning photocurrent microscopy system was used to test the optoelectronic response in the visible. Results of the measurements indicated that almost all devices had excellent current-voltage characteristics. However, the SCPM measurements showed no or inconsistent photosignal in the visible. In addition, optoelectronic testing in the visible and infrared in a variable-temperature probe station did not result in a measurable photoresponse.

Benefits to the Department of Energy:

Improved photodetectors can impact several DOE missions. Nanomaterials such as graphene are promising for such applications, but learning how to fabricate and test such devices is an important step. This project has demonstrated the ability to test such nanodevices, and this capability will be useful for the future exploration of nanomaterials for DOE needs.

Economic Impact:

This project established that one particular design for graphene devices is not promising for optoelectronic applications. This will allow industry to focus on other approaches. Another impact is that a postdoctoral fellow was trained in nanomaterials characterization techniques, and she will be positioned to contribute to the US economy in the future with this new skill set.

Project Status:

The project is completed.

ADDITIONAL INFORMATION

Laboratory/Department of Energy Facility Point of Contact for Information on Project

François Léonard
Sandia National Laboratories
MS9161
Livermore, CA 94551
925-294-3511
fleonar@sandia.gov

Company Size and Points of Contact

Peter V. Bedworth
Lockheed-Martin pace Systems
Palo Alto, CA
Advanced Technology Center
Org. ABBS, Bldg. 204
3251 Hanover St.
Palo Alto, CA 94304-1191
650-424-2554
peter.v.bedworth@lmco.com

CRADA Intellectual Property

None

Technology Commercialization

None


Project Examples

Not Applicable

PROJECT ACCOMPLISHMENTS SUMMARY
Cooperative Research and Development Agreement (SC99/01573.105)
between Sandia National Laboratories and Lockheed Martin Corporation

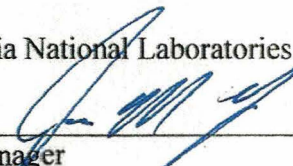
This summary has been approved for public release by Sandia and Lockheed Martin Corporation

Sandia National Laboratories

By 
Francois Leonhard
Principal Investigator

12-6-12
Date

Sandia National Laboratories

By 
Manager
WFO/CRADA Agreements

12.5.12
Date

Lockheed Martin Corporation

By _____
Title:

Date

In order to expedite the process, if we do not receive your signed reply by 01/19/2013
we will assume your concurrence for the release of this document to the public.