National Renewable Energy Laboratory
A national laboratory of the U.S. Department of Energy
Office of Energy Efficiency & Renewable Energy
Innovation for Our Energy Future

Development of Novel Nanocrystal-based Solar Cell to Exploit Multiple Exciton Generation

Cooperative Research and Development Final Report

CRADA Number: CRD-07-00227

NREL Technical Contact: Randy Ellingson

CRADA Report
NREL/TP-7A1-48422
August 2010

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Cooperative Research and Development Final Report

In accordance with Requirements set forth in Article XI.A(3) of the CRADA document, this document is the final CRADA report, including a list of Subject Inventions, to be forwarded to the Office of Science and Technical Information as part of the commitment to the public to demonstrate results of federally funded research.

CRADA number: CRD-07-00227

CRADA Title: Development of Novel Nanocrystal-based Solar Cell to Exploit Multiple Exciton Generation

Parties to the Agreement: Evident Technologies, Inc. + NREL

Joint Work Statement Funding Table showing DOE commitment:

Estimated Costs	**NREL** Shared Resources
Year 1	$ 25,000.00
Year 2	$ 25,000.00
Year 3	$ 00.00
TOTALS	$ 50,000.00
Fed Admin Charge on Funds-in	----

Abstract of CRADA work:

NREL's basic science studies of the photophysical properties of nanocrystals (NCs) have led to observations of unique size-dependent properties which may support inexpensive, highly-efficient Third Generation solar cells for the production of electricity and fuels. NREL's understanding of the photogenerated charge carrier dynamics, including relaxation through interactions with the crystal lattice or NC surface, and the generation of multiple excitons by a single absorbed photon of sufficient energy, can now be leveraged in an effort to develop MEG-active NC-based solar cells. Initial efforts suggest that NC-based devices can in principle operate very efficiently, though the ability to harness MEG remains to be demonstrated. The ability of Evident Technologies to prepare high quality NCs of specific semiconductor material, NC size, and NC shape, will provide very important benefits to NREL's solar cell R&D efforts. Access to a variety of high quality NC materials greatly assists with NREL's efforts to understand and characterize MEG in new types of solar cells.

NREL will conduct research to implement semiconductor NCs into photoconversion device designs in an effort to collect photocurrent at levels enhanced by multiple exciton generation (MEG). The MEG-active solar cell effort aims to develop NC solar cells that demonstrate conversion efficiency enhanced by MEG. In this collaboration, NREL will study the influence of novel NC compositions and shape on NC-solar cell efficiency by methodically preparing high-quality films and devices using novel III-V (e.g. InGaP), I-III-VI (e.g. CIGS), II-VI (e.g. CdSe), and IV-VI (e.g. PbS) quantum dots as well as IV-VI nanorods (NRs) (cylindrical NCs with length-to-diameter ratios ranging from slightly greater than 1 to as large as 20) provided by Evident Technologies Inc.. NREL seeks to study the effect of NR aspect ratio, for varying aspect ratios (shapes) ranging from 1 (spherical) to as large as possible (e.g., lengths exceeding the size of the exciton in bulk material). NREL seeks to develop design strategies utilizing the MEG effect in NCs to enhance the photocurrent and efficiency produced by NC solar cells.

Summary of Research Results:

This project was initiated immediately prior to the unexpected departure from NREL employment of the Technical contact at NREL, Randy Ellingson. No further substantial interaction on the topic of this CRADA occurred between NREL scientists and Evident Technologies.

Subject Inventions listing: None

Report Date: 4/30/10 Responsible Technical Contact at Alliance/NREL: Ellingson, Randy (or Matt Beard)

This document contains NO confidential, protectable, or proprietary information.