NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Super-Resolution Optical Imaging of Biomass Chemical Spatial Structure

Cooperative Research and Development Final Report

CRADA Number: CRD-10-411

NREL Technical Contact: Shi-You Ding

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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-10-411

CRADA Title: Super-Resolution Optical Imaging of Biomass Chemical-Spatial Structure

Parties to the Agreement: South Dakota School of Mines

Joint Work Statement Funding Table Showing DOE Commitment:

Estimated Costs	NREL Shared Resources
Year 1	$ 84,000.00
Year 2	$ 8,000.00
TOTALS	$ 92,000.00

Abstract of CRADA Work:

The primary objective of this effort is to develop the capability to apply new single molecule imaging methods to the study of plant cell structure and the dynamics of cellulase enzyme activity.

Summary of Research Results:

This CRADA supported the development and application of photoactivated localization microscopy (PALM) and defocused orientation and position imaging (DOPI) techniques applied to the nanoscale imaging of nano-cellulose and its interaction with cellulose enzymes and their derivatives, including:

1) DOPI of GFP fused to CBMs and bound to *Valonia* nanocellulose microfibrils, and 2) PALM imaging of PAmcherry PA-FPs fused to CBMs, bound to *Valonia* nanocellulose microfibrils. The work was reported in the following journal and conference publications (one invited, one contributed):

Journal Papers:

Dagel, D.; Zhong, L.l Liu, Y.; Ding, S.-Y; Smith, S. (2011). "*in situ* Defocused Orientation and Position Imaging of Single Carbohydrate Binding Modules on Cellulose Microfibrils." *J Phys Chem B*. (115:4); pp. 635-41.

Invited Presentation and Conference Proceedings:

Smith, S.; Dagel, D.J.; Zhong, L.; Kolla, P.; Ding, S.-Y. "All-optical multi-dimensional imaging of energy-materials beyond the diffraction limit." *SPIE 8306 proceedings;* October 11, 2011. Photonics, Devices, and Systems V, 83061B.

Contributed Presentation and Conference Proceedings:

Dagel, D.J.; Liu, Y.-S.; Zhong, L.; Luo, Y.; Zeng, Y.; Himmel, M.; Ding, S.-Y.; Smith, S. "DOPI and PALM imaging of single carbohydrate binding modules bound to cellulose nanocrystals." *SPIE 7905 proceedings;* February 22, 2011. Single Molecule Spectroscopy and Imaging IV, 79050P.

Subject Inventions Listing: N/A

Report Date: 8/27/2013

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