



Super-Resolution Optical Imaging of Biomass Chemical-Spatial Structure

**Cooperative Research and Development
Final Report**

CRADA Number: CRD-10-410

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.

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

Parties to the Agreement: Colorado School of Mines

Joint Work Statement Funding Table showing DOE commitment:

Estimated Costs	NREL Shared Resources
Year 1	\$ 53,229.00
Year 2	\$ 8,000.00
Year 3	\$ 00.00
TOTALS	\$ 61,229.00

Abstract of CRADA work:

The overall objective for this project is to characterize and develop new methods to visualize the chemical spatial structure of biomass at varying stages of the biomass degradation processes *in situ* during the process.

Summary of Research Results:

A novel nonlinear imaging technology was developed and demonstrated. This is the first microscope capable of simultaneously imaging with single-element detection multiple focal spots and multiple multiphoton modalities. The resulting new methods of nonlinear visualization were reported in the following peer-reviewed publications:

E. Hoover, J. Field, D. Winters, M. Young, E. Chandler, J. Speirs, J. Lapenna, S. Kim, S. Ding, J. Wang, R. Bartels, J. Squier, "Eliminating the scattering ambiguity in multifocal, multimodal, multiphoton imaging systems," *J. of Biophotonics*, 5, No. 5–6, 425–436 (2012).

J. Field, K. Sheetz, E. Chandler, E. Hoover, M. Young, S. Ding, A. Sylvester, D. Kleinfeld, J.A. Squier, "Differential Multiphoton Microscopy," *IEEE JQE*, **invited paper**, 99,1-15 (2011)

The work was presented at an invitational presentation:

Jeff Squier, "Eliminating the scattering ambiguity in multifocal multiphoton imaging systems," **invitational**, Telluride Workshop, "New Frontiers and Grand Challenges in Laser-based Biological Microscopy," August 1-4, 2011.

Subject Inventions Listing: n/a

Report Date: 4/4/2013

Responsible Technical Contact at Alliance/NREL: Shi-You Ding

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