



# **Development of YBCO Superconductor for Electric Systems**

**Cooperative Research and  
Development Final Report**

**CRADA Number: CRD-04-150**

NREL Technical Contact: Raghu Bhattacharya

**NREL is a national laboratory of the U.S. Department of Energy, Office of Energy  
Efficiency & Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.**

**CRADA Report**  
NREL/TP-7A10-57657  
March 2013

Contract No. DE-AC36-08GO28308

## NOTICE

This report was prepared as an account of work sponsored by an agency of the United States government. Neither the United States government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States government or any agency thereof.

Available electronically at <http://www.osti.gov/bridge>

Available for a processing fee to U.S. Department of Energy and its contractors, in paper, from:

U.S. Department of Energy  
Office of Scientific and Technical Information

P.O. Box 62  
Oak Ridge, TN 37831-0062  
phone: 865.576.8401  
fax: 865.576.5728  
email: <mailto:reports@adonis.osti.gov>

Available for sale to the public, in paper, from:

U.S. Department of Commerce  
National Technical Information Service  
5285 Port Royal Road  
Springfield, VA 22161  
phone: 800.553.6847  
fax: 703.605.6900  
email: [orders@ntis.fedworld.gov](mailto:orders@ntis.fedworld.gov)  
online ordering: <http://www.ntis.gov/help/ordermethods.aspx>

Cover Photos: (left to right) PIX 16416, PIX 17423, PIX 16560, PIX 17613, PIX 17436, PIX 17721



Printed on paper containing at least 50% wastepaper, including 10% post consumer waste.

## 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-04-150

**CRADA Title:** Development of YBCO Superconductor for Electric Systems

**Parties to the Agreement:** Super Power, Inc.

### **Joint Work Statement Funding Table showing DOE commitment:**

<b>Estimated Costs</b>	<b>NREL Shared Resources</b>
Year 1	\$ 50,000.00
Year 2-4	\$ 200,000.00
Year 5	\$ 50,000.00
Year 6	\$ 300,000.00
Year 7-8	\$ 100,000.00
TOTALS	\$ <u>700,000.00</u>

### **Abstract of CRADA work:**

The proposed project will be collaborative in exploration of high temperature superconductor oxide films between SuperPower, Inc. and the National Renewable Energy Laboratory. This CRADA will attempt to develop YBCO based high temperature oxide technology.

### **Summary of Research Results:**

We have successfully prepared electrodeposited Ag-stabilization and Cu-stabilization layers on high  $T_c$  YBCO superconductors. The following papers were published.

1. Bhattacharya, Raghu. N.; Mann, Jonathan; Qiao Yunfei; Zhang, Yue; and Selvamanickam, Venkat; "Electrodeposited Ag-stabilization layer for high temperature superconducting coated conductors," *Advances and Applications in Electroceramics: Ceramic Transactions*, vol. 226, pp 137-144, 2011.
2. Selvamanickam, V.; Chen, Y.; Kesgin, I.; Guevara, A.; Shi, T.; Yao, Y.; Qiao, Y.; Zhang, Y.; Majkic, G.; Carota, G.; Rar, A.; Xie, Y.; Dackow, J.; Maiorov, B.; Civale, L.; Braccini, V.; Jaroszynski, J.; Xu, A.; Larbalestier, D.; and Bhattacharya, R.;

“Progress in Performance Improvement and New Research Areas for Cost Reduction of 2G HTS Wires,” *IEEE Transactions on Applied Superconductivity*, vol. 21, No.3, pp 3049-3054, 2011.

3. Bhattacharya, R.N.; Qiao, Y.; and, Selvamanickam, Venkat; “Electrodeposited Cu-stabilization Layer for High Temperature Superconducting Coated Conductors,” *Journal of Superconductivity and Novel Magnetism*, Volume 24, Numbers 1-2, pp 1021-1026 (6), 2011.

**Subject Inventions Listing:**

U.S. Application No. 12/033,660, filed February 19, 2008, “Method of Forming an HTS Article”

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