

OAK RIDGE
NATIONAL LABORATORY

MANAGED BY UT-BATTELLE
FOR THE DEPARTMENT OF ENERGY



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1.0 Abstract

Second generation (2G) technologies to fabricate high-performance superconducting wires developed at the Oak Ridge National Laboratory (ORNL) were transferred to American Superconductor via this CRADA. In addition, co-development of technologies for over a decade was done to enable fabrication of commercial high-temperature superconducting (HTS) wires with high performance. The massive success of this CRADA has allowed American Superconductor Corporation (AMSC) to become a global leader in the fabrication of HTS wire and the technology is fully based on the Rolling Assisted Biaxially Textured Substrates (RABiTS) technology invented and developed at ORNL.

2.0 Statement of Objectives

The overall purpose of this CRADA was to support development of a low-cost manufacturing process for 2G HTS wire at American Superconductor (AMSC) wide-strip MOD-YBCO/RABiTS technology. This collaborative project was focused directly at the development of the HTS wire required for the DOE mission of developing of novel and revolutionary electric power equipment, such as cables, fault current limiters, and transformers, utilizing HTS wires. This goal was pursued through the joint development of improved materials and manufacturing processes leading to yield and performance improvements and manufacturing cost reductions. Specific technical goals for over the years were:

- Technology transfer and optimization of single-crystal-like, alloy substrates with high-strength and reduced magnetism
- Technology transfer and optimization of heteroepitaxial buffer layers on single-crystal-like, alloy substrates with high-strength and reduced magnetism
- Technology transfer and optimization of heteroepitaxial superconductor layers on the heteroepitaxial buffer layers on single-crystal-like, alloy substrates with high-strength and reduced magnetism
- Measurement and characterization of superconducting properties and correlation with microstructures and processing for further process optimization
- Overall cost-reductions by developing lower-cost deposition processes such as high-speed solution deposition methods

3.0 Benefits to Funding DOE Office's Mission

Oak Ridge National Laboratory (ORNL) assisted the Department of Energy (DOE) Office of Electricity Delivery and Energy Reliability (OE) to lead national efforts to modernize the electric grid, to enhance security and reliability of the energy infrastructure, and to facilitate recovery from disruptions to energy supply. This project in partnership with American Superconductor Corporation advanced the technology, and operating costs to fabricate high-performance HTS wires for use in devices that enable a more reliable and resilient electricity and energy

infrastructure. This project resulted in world-wide American leadership in this important area of high-temperature superconductivity applications.

4.0 Technical Discussion of Work Performed by All Parties

All objectives of the CRADA were fully met. AMSC now has a fully operating factory in Devans, MA and is the world-wide leader in fabrication of HTS wires. Successful technology transfer from ORNL in the areas of substrate fabrication, buffer layer deposition and HTS deposition was realized. In addition, joint co-development for over a decade between AMSC and ORNL, now permits AMSC to fabricate the highest performance HTS wire at a low-cost.

5.0 Subject Inventions

AMSC has licensed a whole portfolio of US and world-wide patents from ORNL. In addition, some joint invention disclosures were submitted and filed.

6.0 Commercialization Possibilities

The technology has been fully commercialized by AMSC and the CRADA has been completely successful.

7.0 Plans for Future Collaboration

Informal collaboration continues as needed. We plan to submit proposals for funding continued joint technology development with AMSC.

8.0 Conclusions

This has been one of the most successful technology transfer projects in the history ever. AMSC has geared all its HTS wire production based on ORNL invented and developed technology that was licensed and transferred to AMSC via this CRADA. Today AMSC is the global leader in production of low-cost, high-performance HTS wire.

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