Y-12

OAK RIDGE Y-12 PLANT

Project Accomplish Summary
for
Project Number 93-Y12P-056-C1

MOLDABLE TRANSIENT SUPPRESSION POLYMER
COMPOSITE

RECEIVED

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PROJECT ACCOMPLISHMENT SUMMARY

Title: MOLDABLE TRANSIENT SUPPRESSION POLYMER COMPOSITE

DOE TTI Number: 93-Y12P-056-C1

CRADA Number: Y-12 94-0273

Partner: General Electric Company

BACKGROUND

Circuit breakers are used to protect almost everything electrical in both weapons systems and civilian applications. Polymer-composite breakers are the circuit breakers of choice because they are inexpensive, rugged, and reset automatically. Protection is needed at higher current levels than the polymer-composite breakers provide, and there are financial incentives to develop them for high current use. Thus, performance improvements and cost savings can result from the successful development of the polymer-composite breakers for higher-current applications.

The complementary use of GE and MMES resources accelerated development of composite materials for electrical protective devices. MMES used unique expertise with heavily filled polymers that was developed in defense related programs; this expertise made an important contribution to the project. MMES also used its extensive experience with the development of materials for electrical transient suppression as well as its electrical test facilities and analytical capabilities to support the project. General Electric (GE) is a leading manufacturer of electrical equipment and electronics and has manufacturing and marketing capabilities along with extensive research and development capabilities at its Corporate R&D Center (GE-CRD). GE also can call upon the product engineering capabilities of its manufacturing divisions. In particular, the GE Electrical Distribution and Control (GE-ED&C), Plainville, Connecticut, is a leading manufacturer of circuit protective and switching devices and can manufacture current limiting devices based upon moldable transient suppression polymer composite materials.

DESCRIPTION

The objective of the CRADA was to cooperate in the development of a moldable transient suppression polymer composite that can be used to protect electrical equipment and electronics from damage caused by electrical disturbances and faults. The composite was to provide a solid-state means of fault current limitation, particularly for high-current applications. The composite was envisioned to have the following properties: (1) be moldable and therefore suited to the automated manufacture at a low cost; (2) operate with greater speed and reliability than electromechanical devices; and (3) operate in conjunction with appropriately designated

mechanical breakers to limit the current and energy under short-circuit fault conditions, thereby providing improved protection to equipment connected to the circuit.

The technical work of the project was in part shared between Lockheed Martin and the General Electric Company and in part divided between the participants according to their capabilities. Work was performed in the Oak Ridge K-25, Y-12, and X-10 facilities of Lockheed Martin and at the General Electric Company Corporate Research and Development (GE-CR&D) and Electrical Distribution and Control (GE-ED&C) facilities. Materials were fabricated in facilities of the Y-12 Development Department, where polymers were filled with varying amounts of conductive materials. However, as the effort was reduced because of curtailed DOE funding, GE took over fabrication of filled epoxies and then assumed responsibility for all materials fabrication. Electrical testing and theoretical modeling by Lockheed-Martin were performed at X-10, excepting that some pulse testing of materials and the development of specialized pulse test apparatus was done at the K-25 site. GE shared in low-power electrical testing at CR&D and performed high-power electrical testing using specialized facilities at the ED&C. GE took responsibility for setting the performance requirements of the materials for their product applications. Other phases of the project such as product integration, breaker design, manufacturing, and marketing were considered solely the responsibilities of GE. Similarly, the tooling required for manufacture was a responsibility of the General Electric Company.

The objectives of the CRADA had not been met when it was terminated by the DOE, but much progress had been made toward the project goals. A large variety of composites was fabricated by filling various polymers with conductors or semiconductors, and electrical testing was used to identify the promising materials. Theoretical analyses were performed to gain better understanding of some of the associated electrical phenomena. The progress toward the goals of the CRADA proved sufficient for the General Electric Company to continue to develop the materials without a DOE sponsored partner.

BENEFITS TO DOE

Thus far, the CRADA's Defense Programs sponsor may have benefited by maintenance and refinement of technical capabilities that were used in the work of the project, if such maintenance is in fact considered a benefit. However, the project may yet be brought to a successful conclusion by GE. If GE is successful, the Defense Programs sponsor could benefit from the availability of electrical protection that will increase the reliability of weapons systems as well as supporting systems and infrastructure used in weapons manufacture. A GE success could provide devices that harden weapons and supporting systems against electrical faults of all kinds.

These benefits could support strategic Defense Programs R & D goals, although no specific knowledge of such goals is claimed.

ECONOMIC IMPACT

The General Electric Company declines to reveal the current status or the future plans for the project.

PROJECT STATUS

The DOE Defense Programs sponsor terminated all its support for this project in 1995.

DOE FACILITY POINT(S) OF CONTACT FOR PROJECT INFORMATION

The project and PAS development responsibilities for the project belong to:

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COMPANY SIZE AND POINT(S) OF CONTACT

The GE personnel responsible for the project did not provide feedback on the progress of the project. They consider such information as GE business proprietary and recognize no DOE claim to such information. The GE Principal Investigator was :

L. M. Levinson
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PROJECT EXAMPLES

None are available.

TECHNOLOGY COMMERCIALIZATION

The commercialization plan is the responsibility of GE, and GE did not provide it.

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