PROJECT DATA

Haun Labs - 03GO13014

Energy Saving Method of Manufacturing Ceramic Products from Fiber Glass Waste

Recipient:	Haun Labs	Instrument Number:	DE-FG36-03GO13014
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Subcontractor(s):		B&R Number(s):	ED1906020
		PES Number(s):	03-10065, 03-10157
EERE Program:	Industrial Technologies	State Congressional District:	CA - 6

PROJECT SCOPE: The objective of this project is to provide the basis for the design and construction of an energy-efficient manufacturing plant that can convert large volumes of fiber glass waste into high-quality ceramic tile. The main objectives are to complete process development and optimization, construct and test prototype samples, conduct market analysis and commercialization planning, and to design an industrial demonstration plant.

FINANCIAL ASSISTANCE

Approved DOE Budget:	$200,000	Approved DOE Share:	$200,000
Obligated DOE Funds:	$200,000	Cost Share:	$50,000
Remaining Obligation:	$0		
Unpaid Balance:	$94,240	**TOTAL PROJECT:**	**$250,000**

Project Period: 4/15/03-4/15/05

TECHNICAL PERFORMANCE

DE-FG36-03GO13014

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PROJECT SYNOPSIS

The objective of this project is to provide the basis for the design and construction of an energy-efficient manufacturing plant that can convert large volumes of fiberglass waste into high-quality ceramic tile. The main objectives are to complete process development and optimization, construct and test prototype samples, conduct market analysis and commercialization planning, and to design an industrial demonstration plant.

SUMMARY OF TECHNICAL PROGRESS

Various samples of fiber glass reinforcement and insulation waste samples from fiber glass manufacturers were investigated and methods developed to process all of the waste types into powder, the process variables were optimized for both reinforcement and insulation types of fiber glass waste. Characterization was done by Differential Thermal Analysis (DTA) and Thermo Gravimetric Analysis (TGA), as well as X-Ray Diffraction (XRD).

The optimized procedure was then used to begin fabricating prototype ceramic tile for American National Standards Institute (ANSI) Standards Testing and for demonstration samples. The ANSI testing showed that tiles made from both giver glass reinforcement waste and fiber glass insulation waste surpassed the standards set for porcelain, the highest quality tile, in Water Absorption, Bond Strength, Breaking Strength, Chemical Resistance, Freeze-Thaw Cycling and Scratch Hardness. The tiles made from fiber glass reinforcement waste also surpassed the porcelain standards for Abrasion Resistance; however, the tiles made from fiber glass insulation waste fell between the clay-based and the porcelain tiles in the Abrasion Resistance test. Samples were made in a range of colors; however, due to higher levels of iron-oxide in some fiber glass waste, lighter colors are not always possible to make from all waste. Additional colorants were evaluated to extend the range of colors. Variations in particle size of granulated powders and combinations of more than one type and color of the powders were used to produce speckled-color appearances. Combinations of different glass particle sizes were also investigated to produce speckled colors and to add a transparent appearance compared to the translucent appearance previously developed. Surface finishes and textures can be produced ranging from matte to glossy and smooth to rough.

Equipment evaluations were conducted for the main steps of the process: mixing/granulating, pressing, and firing. Production scale equipment was used to evaluate the scale-up of all main steps with good results. By using production-scale equipment, compared to the previous lab-scale process, several improvements in the processing and properties of the tile were observed. These improvements include: enhanced mixing and granulating; higher green strength after pressing; and greater control over the surface appearance of fired tile.

The Market Analysis was used to develop the initial product focus and market introduction strategy. Extensive discussions of the technology and the project were conducted with manufacturers. An industrial partner has been selected and a technology development and licensing agreement was completed with the partner. This will lead to commercialization of the technology.

SUMMARY OF PLANNED WORK

Work will continue on the Phase II Development of Product Formulations to further develop the processing methods for manufacturing the initial product types. Work will begin on the Final Demonstration Plant Design to complete the scale-up activities and final design of the manufacturing process and equipment selection. The project is currently planned for completion before the end of 2004, well ahead of schedule.

PROJECT ANALYSIS

The project is on schedule and within budget and no major obstacles are seen that would prevent Haun Labs from successfully completing the project.

The Principal Investigator attended the world's largest international ceramic tile trade show, Coverings, in March 2004. The industrial fiber glass company that has partnered with Haun Labs also attended and met with selected tile companies to show demonstration samples and to explore possible collaboration. Partnering with a tile company offers several advantages to rapidly commercialize the technology, including the use of existing manufacturing facilities and established distribution channels. Partnering with a tile company appears very likely.

ACTION REQUIRED BY DOE HEADQUARTERS

No action is required from DOE Headquarters at this time.

STATEMENT OF WORK

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Detailed Task Description

Task 1. Phase 1 Development and Training

Task 1.1 Optimization of Process Variables

Reducing the fiber glass waste into a glass powder; mixing the glass powder with additives into a glass-additives mixture; granulating the glass-additives mixture into granulated particles; forming the granulated particles into a green ceramic article; and firing the green ceramic article into the ceramic product.

Task 1.2 Glass Powder Characterization

This task will determine the characteristics and properties of the glass fiber. For example, fiber length and size, surface area, composition, and thermal behavior.

Task 1.3 Phase I Prototype Fabrication

An optimized processing method will then be selected for fabrication of prototype samples.

Task 1.4 Phase I Prototype ANSI Testing

The following properties will be measured: moisture expansion, water absorption, bond strength, thermal shock resistance, wear resistance, breaking strength, chemical resistance, modulus of rupture, frost resistance, coefficient of friction, and scratch hardness.

Task 1.5 Phase I Demonstration Samples & Data

Data sheets of the results will be prepared for distribution with sample prototypes.

Task 2. Phase 2 Development and Training

Task 2.1 Product Formulations

Task 2.2 Formulation Characterizations

Task 2.3 Phase II Prototype Fabrications

Task 2.4 Phase II Prototype ANSI Testing

Task 2.5 Phase II Demonstration Samples & Data

Task 3. Plant Design/Cost Analysis

Task 3.1 Initial Demonstration Plant Design

A demonstration plant will be initially designed with a capacity of producing 500,000 sq. ft of tile annually from 2,000,000 lbs of fiberglass waste.

Task 3.2 Equipment Evaluations

Evaluations will be conducted with equipment manufacturers to select the most suitable equipment for the process.

Task 3.3 Final Demonstration Plant Design

Task 4. Market Analysis/Commercialization Plan

Task 4.1 Conduct Additional Market Analysis

Task 4.2 Determine Initial Product Focus

Task 4.3 Expand Commercialization Plan

Task 4.4 Investigate Potential Industrial Partners

Task 4.5 Conferences & Trade Shows

Task 5. Project Management & Reporting

Haun Labs is responsible for submitting both Semi-annual Progress Reports and a Final Report to DOE. The Semi-annual Reports are due every April 30 and October 31. The Final Report is due 90 days after the project completion date as specified in the agreement. This task also includes other DOE requirements for market assessments, fact sheets, benefits analyses, workshops, etc.

Project Cost Performance in DOE Dollars for Fiscal Year 2003

DE-FG36-03GO13014 **Haun Labs**

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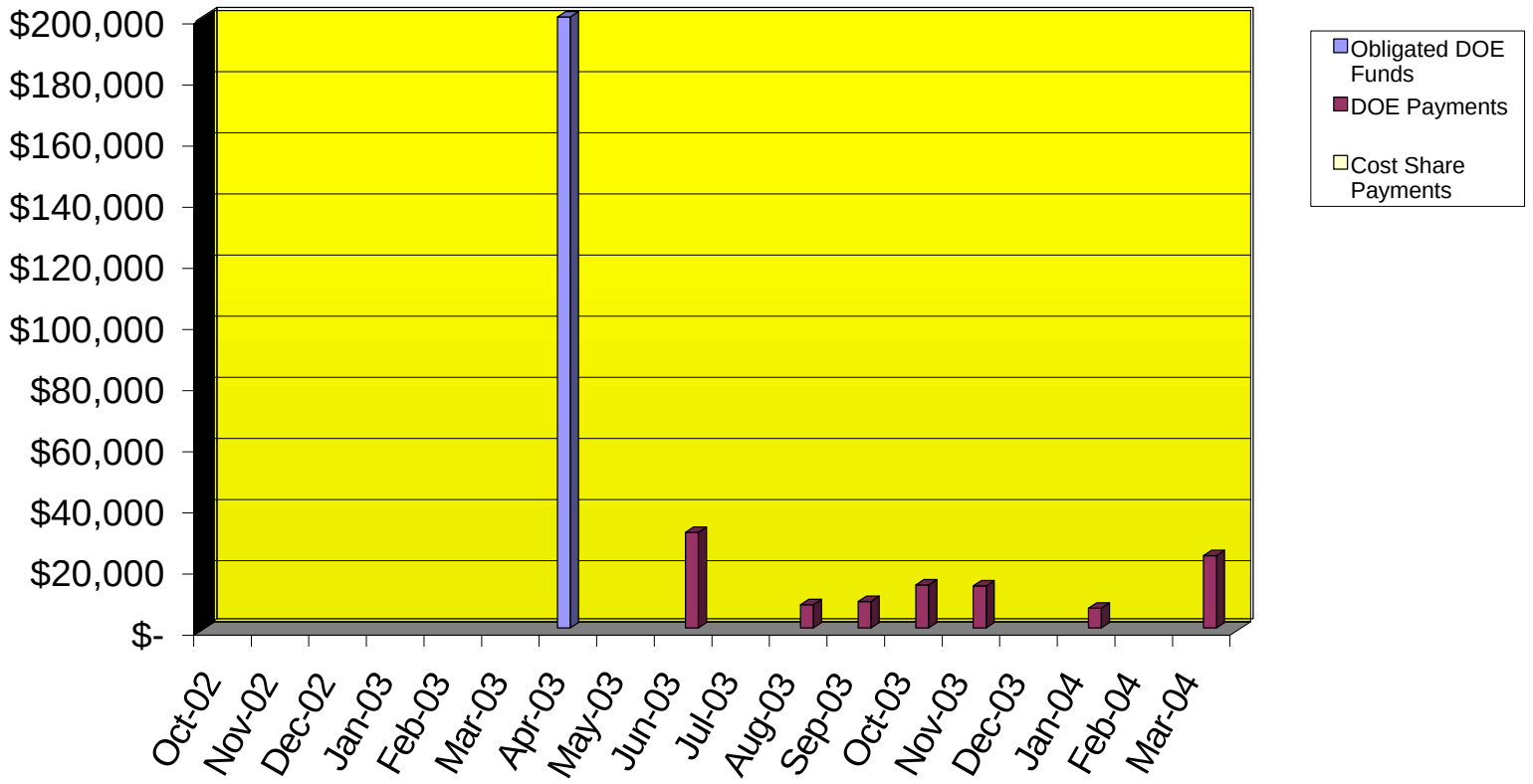

	Oct-02	Nov-02	Dec-02	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Jun-03	Jul-03	Aug-03	Sep-03
Obligated DOE Funds	$0	$0	$0	$0	$0	$0	$200,000	$0	$0	$0	$0	$0
DOE Payment	$0	$0	$0	$0	$0	$0	$0	$0	$31,293	$0	$7,680	$8,640
Cost Share Payment	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

	Oct-03	Nov-03	Dec-03	Jan-04	Feb-04	Mar-04	PFY*	Cumulative
Obligated DOE Funds	$0	$0	$0	$0	$0	$0	$0	$200,000
DOE Payment	$14,125	$13,835	$0	$6,507	$0	$23,680	$0	$105,760
Cost Share Payment	$0	$0	$0	$0	$0	$0	$0	$0

Approved DOE Budget:	$200,000
Approved Cost Share Budget:	$50,000
Total Project Budget:	$250,000

* Prior Fiscal Years

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