PROJECT DATA

PoroGen, LLC - 03GO13167

Chemically Inert Membranes

Recipient:	PoroGen, LLC	Instrument Number:	DE-FG36-03GO13167
Recipient Project Director:	Dr. Leon Mir 617.244.8083 238 Andover Street Wilmington, MA 01887	CPS Number:	17827
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Recipient Type:	For Profit Organization	GO Contract Specialist:	Melissa Wise 303.275.4907
Subcontractor(s):		B&R Number(s):	ED1906020
		PES Number(s):	03-10157
EERE Program:	Industrial Technologies	State Congressional District:	MA - 6

PROJECT SCOPE: The objective of this project is to demonstrate the technical feasibility of developing a robust polymeric membrane for separation of solvent/oil mixtures. The membrane will be manufactured from an advanced engineering polymer, Polymer A. Membranes prepared from Polymer A are currently not available commercially as the desireable properties of the membrane material make its preparation exceedingly difficult. PoroGen plans to overcome this hurdle by developing a novel melt processing and decomposition two-step process.

FINANCIAL ASSISTANCE

Approved DOE Budget:	$65,000	Approved DOE Share:	$65,000
Obligated DOE Funds:	$65,000	Cost Share:	$10,000
Remaining Obligation:	$0		
Unpaid Balance:	$32,622	**TOTAL PROJECT:**	**$75,000**

Project Period: 9/30/03-10/30/04

TECHNICAL PERFORMANCE

DE-FG36-03GO13167

PoroGen, LLC

Chemically Inert Membranes

PROJECT SYNOPSIS

The objective of this project is to demonstrate the technical feasibility of developing a robust polymeric membrane for separation of solvent/oil mixtures. The membrane will be manufactured from an advanced engineering polymer, Polymer A. Polymer A is a commercially available high-performance polymer that is inert to organic solvents and exhibits thermo-mechanical characteristics superior to most engineering polymers. Membranes prepared from polymer A are currently not available commercially as the properties that make the polymer desireable make its preparation exceedingly difficult. PoroGen plans to overcome this hurdle by developing a novel melt processing and decomposition two-step process.

SUMMARY OF TECHNICAL PROGRESS

A commercially available high performance polymer with excellent high temperature capability and chemical resistance was chosen for the fabrication of the novel membrane (Polymer A). A novel two step process was utilized to prepare the porous solvent resistant membrane. In the first step, a precursor film of the polymer blend of Polymer A and Polymer B was formed by compression molding. Polymer B serves as a porogen and processing aid. In the second step, the Polymer B is decomposed into lower molecular weight molecules and is dissolved in solvent for removal. The process has been named Reactive Porogen Removal process (RPR). Porous solvent resistant membranes obtained by the RPR process are mechanically strong and exhibit excellent integrity. The presence of nanometer-sized pores was confirmed by extensive testing.

The porous membranes were confirmed to contain uniform interconnected pores. The gas transport properties of the porous membrane are very close to the theoretical maximum Knudsen flow, indicating that all pores are small (below 50 nm) and the membranes are defect free. The presence of defects would result in no gas separation. The measured gas and permeances are high and of commercial value. Based on the bubble point method, the maximum pore sizes are 15 nm for the PG50 membrane and 38 nm for the PG30 membrane.

The solvent resistance of the novel membranes was demonstrated by performing solvent permeation tests. A series of organic solvents with a broad range of solubility parameters and polarities were utilized in the test. The membrane performance was tested sequentially with water, isopropanol, IPA, and then with selected organic solvents. After a test with a specific solvent was completed, the membrane flux was then re-measured with IPA as the baseline performance to determine the effect of the respective solvent on the membrane performance. A change in the IPA flux would indicate a change in membrane porosity as the result of exposure to the solvent. The novel membranes developed in this program can be thus utilized for separation of soluble compounds from a broad range of aggressive organic solvent systems, including alcohols, aromatic solvents, halogenated solvents and aprotic solvents. The membrane exhibits a constant gas separation factor up to the maximum treatment of 300^{o}C.

SUMMARY OF PLANNED WORK

The project is complete and the final report was submitted to GO in April 2004.

PROJECT ANALYSIS

This project has been completed successfully. It was on time and within budget. PoroGen is planning to apply for a Category 2 Inventions and Innovation grant to scale up the technology and to develop a commercial scale membrane module. The commercial scale module will be beta-site field test ready and will be characterized by lab testing prior to field tests.

ACTION REQUIRED BY DOE HEADQUARTERS

No action is required from DOE Headquarters at this time.

STATEMENT OF WORK

DE-FG36-03GO13167
PoroGen, LLC
Chemically Inert Membranes

Detailed Task Description

Task 1: Demonstrate formation of porous flat sheet solvent resistant membranes

Task 2: Analytical characterization

Task 2A: Pore size measurements
Task 2B: Gas transport property measurement
Task 2C: Bubble point measurement

Task 3: Demonstrate temperature and solvent resistance of chemically inert membranes

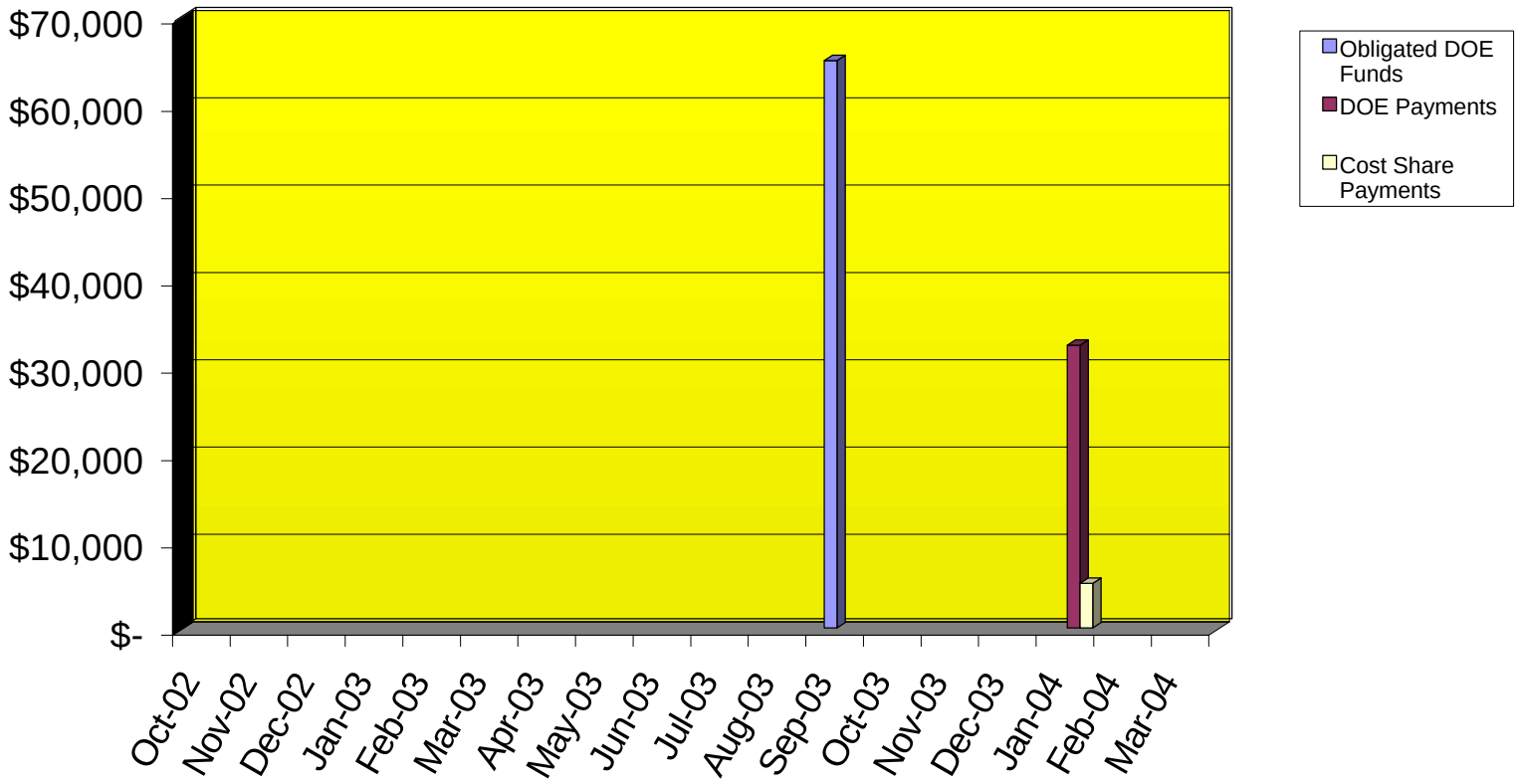
Task 3A: Solvent resistance and separation performance measurement
Task 3B: High temperature capability measurement

Task 4: Prepare and submit the Final Report

Project Cost Performance in DOE Dollars for Fiscal Year 2003

DE-FG36-03GO13167 **PoroGen, LLC**

Chemically Inert Membranes



	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	$0	$0	$0	$0	$0	$65,000
DOE Payment	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
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	$65,000
DOE Payment	$0	$0	$0	$32,378	$0	$0	$0	$32,378
Cost Share Payment	$0	$0	$0	$5,100	$0	$0	$0	$5,100

Approved DOE Budget:	$65,000
Approved Cost Share Budget:	$10,000
Total Project Budget:	$75,000

* Prior Fiscal Years

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ID	Task Name
1	Task 1: Demonstrate Formation of Porous Flat Sheet Membrane
2	Task 2: Analytical Characterization
3	Task 3: Demonstrate Temperature and Solvent Resistant
4	Task 4: Prepare and Submit Final Report