Amercom, Incorporated

Chemical Vapor Infiltration

CFCC

Objective

The Amercom team plans to introduce CFCC components as commercial hardware to a variety of U.S.-based industrial markets.

Materials and Processes

Amercom's material consists of a ceramic fiber, a fiber/matrix interface, and a ceramic matrix combined to form a continuous fiber reinforced composite. The fiber reinforcement, which can be carbon, silicon carbide, or oxide-based, is woven into the desired structure using conventional textile forming techniques. The textile can then be cut, sewn, laminated, and/or tooled to form a net-shape fibrous preform for subsequent processing.

Amercom employs a chemical vapor infiltration (CVI) process to deposit the fiber-matrix interface layer(s) and the ceramic matrix. Amercom employs a proprietary non-oxidizing interface (NOI) layer and pyrolytic carbon to control the properties of the fiber-matrix interface. Interface selection is based on a component's operating environment. Silicon carbide is used as the matrix for all of Amercom's CFCC components.

Applications and Benefits

CVI technology has demonstrated the near-net shape fabrication of large, complex structures. In many cases it would be difficult, or impossible, to fabricate these structures using other compositing technologies. Amercom will initially penetrate the market by using its CVI technology to produce three CFCC components:

Hot gas recirculation fans - CFCC fans will operate at higher temperatures and rotational speeds than current metal fans in areas such as industrial heat treatment furnaces. The benefits include improved throughput, efficiency, and uniformity for the heat treatment process.

Hot gas filters - Long-life filters are urgently needed for advanced filtration bed and coal gasification systems. CFCC filters will solve reliability problems for removing corrosive coal ash particles and pollutants before hot gases enter the power turbine.

Diesel engine piston rings - Carbon-reinforced CFCC piston rings will improve thermal stability at higher temperatures and reduce wear, cyclic fatigue, and distortion. These benefits combine to reduce engine emissions and increase fuel efficiency.

Challenges

The Amercom team must overcome several key technical issues before their CFCC components can be commercialized. The primary challenge is the development of a functional and reliable NOI. CFCC's with an NOI exhibit tough, non-catastrophic fracture characteristics throughout their service lifetimes. Amercom's NOI is being applied to demonstration CFCC components. A secondary challenge is the development of a cold tooling process, which would greatly reduce manufacturing costs. A cold-tooling approach has been used to form parts for the CFCC hot gas fan. Process refinements are underway to utilize the cold tooling process for the fabrication of other CFCC components.

Team Members

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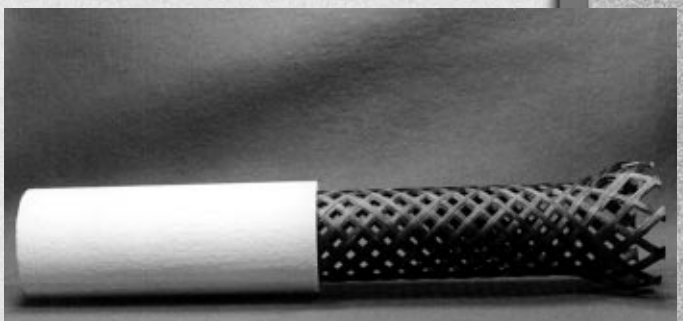

A cut away of a CFCC Strongback™ reinforced Fibrosic™ candle filter. Right side shows Strongback™ reinforcement structure with the filter medium removed. Left side shows the vacuum formed Fibrosic™ with the filter medium

Team Contact

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Continuous Fiber Ceramic Composite Program

A 10-year joint R&D effort initiated in 1992 to develop processing methods to produce reliable and cost-effective CFCC components for industrial applications.

CFCCs are light, strong, and corrosion-resistant materials capable of performing at high temperatures.

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