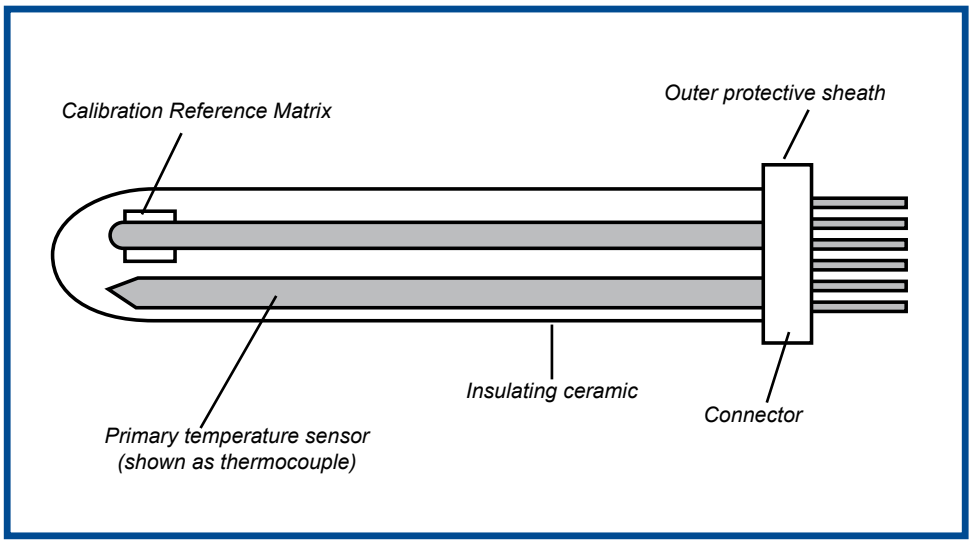
Molybdenum Disilicide Composites for Glass Processing Sensors

Robust Composite Tubes Would Dramatically Improve Glass Sensor Performance

A variety of advanced sensors used to increase the efficiency of glass manufacturing must be immersed in or placed in close proximity to molten glass. In order to optimize use of these sensors, the industry needs inexpensive, corrosion- and thermal shock-resistant materials to protect them. Los Alamos National Laboratory worked with Corning, Accutru International Corporation, Combustion Tec, Exotherm, and the Institute of Gas Technology to develop molybdenum disilicide hybrid composite tubes and coatings for thermocouple sheath applications. The molybdenum disilicide tubes offer numerous advantages. They are electronically conductive, stronger than ceramic refractory materials, free of environmentally detrimental chromium, and corrosion-resistant to molten glass environments. In addition, the new material is less expensive than noble metals as well as oxidation-resistant, allowing immersion without water cooling.



The molybdenum disilicide tube would provide robust protection to dramatically improve glass sensor performance.

Benefits for Our Industry and Our Nation

- Increased production efficiency–availability of robust, affordable material will facilitate the widespread use of advanced sensors and controls designed to improve the manufacturing process
- Reduced manufacturing costs, since the composites are less expensive than noble metals
- No adverse environmental implications, as the composites are chromium-free

Applications in Our Nation's Industry

Since these new, affordable materials can withstand the severe mechanical and thermal stress of glass furnaces, they can be used throughout the glass industry for a variety of sensors and controls to improve the manufacturing process both cost-effectively and without any adverse environmental effects.

Project Description

Goal: Develop robust, thermal shock-resistant molybdenum disilicide composite tubes and coatings for thermocouple sheath applications using unique plasma spray-forming techniques.

The research partnership will establish and optimize plasma spray-forming techniques for creating the composite tubes, which can be used as sheaths for sensors or as periscopic sight tubes for closed-circuit video sensors in glass furnaces.

Progress and Milestones

- Advanced plasma spray-forming techniques have been developed for the fabrication of molybdenum disilicide-aluminum oxide protective tubular sensor sheaths.
- Coated, laminated, and functionally graded molybdenum disilicide-aluminum oxide sheath configurations have been produced and characterized.
- Molybdenum disilicide coated-aluminum oxide tubular sheaths made at the Los Alamos National Laboratory have been provided to the Accutru International Corporation for testing in association with their self-verifying temperature sensor. Accutru distributed these sheaths to nine glass companies for initial molten glass corrosion evaluations in their individual molten glass compositions.
- Molybdenum disilicide composite tubes have been produced by the Exotherm Corporation using a low cost combustion synthesis process.
- Los Alamos National Laboratory was granted two patents in 2001 regarding methods used to produce molybdenum disilicide composites (#6,197,247 and #6,300,265).
- This project concluded in 2001.

Project Partners

Accutru International Corporation
Kingwood, TX

Combustion Tec Inc.
Apopka, FL

Corning, Incorporated
Corning, NY

Exotherm Corporation
Houston, TX

Institute of Gas Technology
Des Plaines, IL

Los Alamos National Laboratory
Los Alamos, NM

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