Advanced Materials and Manufacturing Processes for MW-scale SOFC Power Systems for Improved Stack Reliability, Durability and Cost

Objectives*

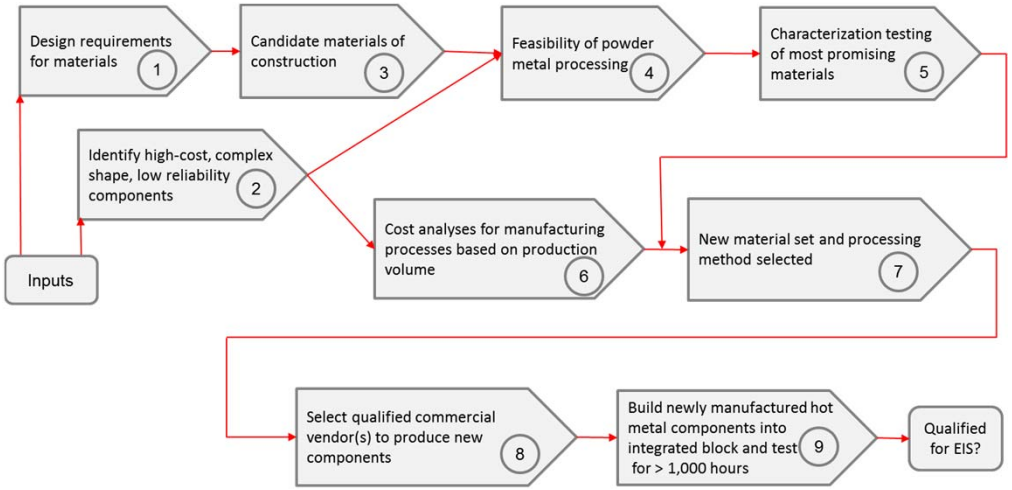
The objective of the proposed work is to qualify a materials and process solution for selected metallic components of an advanced integrated stack block for the entry-into-service (EIS) product that will significantly reduce the cost of these components, and increase the reliability and endurance of the LG Fuel Cell Systems Inc. cell and stack technology.

- identify and validate a material solution for the "hot metal components" with foresight on how the components will be mass produced,
- validate the new process solution for making quality parts that will meet product cost targets
- demonstrate that the new material and components do not adversely impact stack performance while operating on pipeline natural gas.

Scope of Work*

- The material requirements, detailed component designs, and current processes for making a number of the complex hot metal components will be reviewed with our partner, Carpenter Technology.
- Carpenter Technology will then identify candidate materials, as well as alternative, advanced manufacturing processes by which the hot metal components can be made such that material and processing costs can be significantly reduced.
- Further material characterization testing and metallographic examinations of the candidate materials to confirm key properties will be conducted.
- The feasibility for powder metal processing of the top candidate materials, as well as use of powder metal fabrication processes to produce net shape, or near net shapes, will be established for the selected components.
- Based on the results of the materials testing, processing trials, and cost analyses a new material and advanced fabrication process for producing these parts will be selected. A qualified commercial vendor(s) will then produce the new components for validation in an integrated stack block test.
- An integrated block using the newly manufactured hot metal components will be tested by LG Fuel Cell Systems Inc. for at least 1,000 hours, using full-size fuel cells, and operating on pipeline natural gas. The test is intended to validate the reliability and robustness of the newly manufactured components, and to confirm no deleterious impact on the performance of the fuel cell stacks.

* Proposed application titled "Advanced Materials and Manufacturing Processes for MW-scale SOFC Power Systems for Improved Stack Reliability, Durability and Cost" has been selected for negotiations leading to award – **contract has not been finalized.**



Advanced Materials – Establish Design Requirements

Material Groups	Environment	Component
Group 1	Fuel & air environment	• Anode ejector • Fuel loop pipework
Group 2	Air only environment & no contact with fuel cell stack – highest temperature during heat-up. Minimal creep under self weight. 9% water	• Auxiliary ejector diffuser • Auxiliary loop duct work – auxiliary ejector exit to heat exchanger inlet
Group 3	Air only environment with no contact with fuel cell stack	• Auxiliary ejector body & mixing tube
Group 4	Air only environment – Fuel cell stack air exposure	• Cathode ejector & diffuser • Air loop ductwork

Advanced Manufacturing Processes

- **Hot Isostatic Pressing (HIP)**, used to make large near net shapes
- **Powder Injection Molding (PIM)**, which is capable of producing small, intricate shapes in high volume
- **Additive Manufacturing (AM)**, which is an emerging technology with many possibilities, including the ability to manufacture complex pieces with internal channels, and different compositions.

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