

High Performance Catalytic Heat Exchanger for SOFC Systems

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Project Objective

Demonstrate conceptual feasibility of a highly effective catalytic cathode air preheater for a 300kW SOFC power plant to increase plant performance and to reduce the balance of plant cost.

Team Partners

FuelCell Energy, Inc.
Danbury, CT



FuelCell Energy

Modine
Manufacturing Co.
Racine, WI



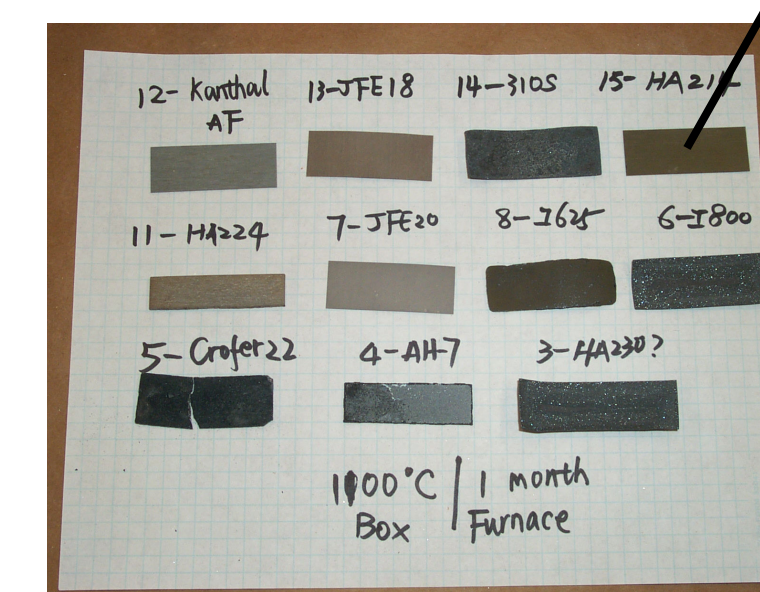
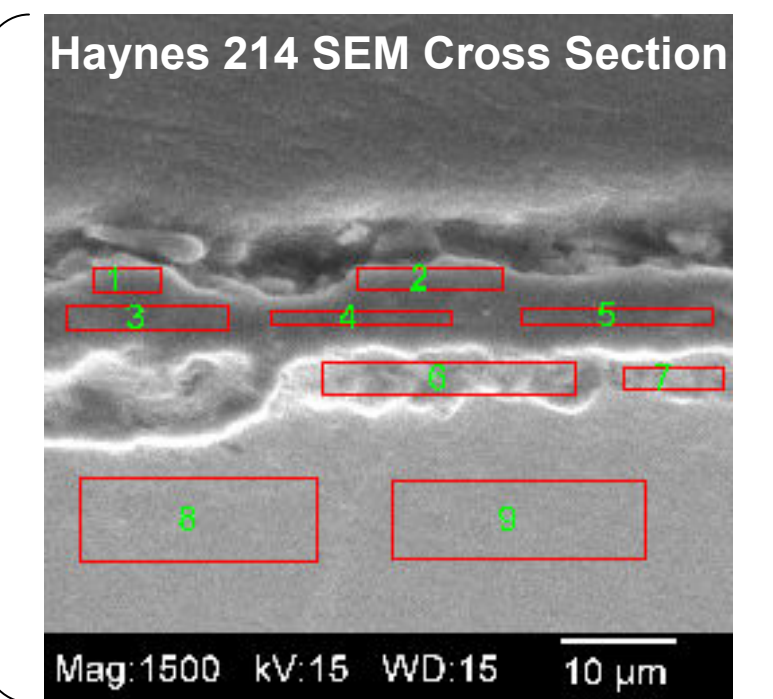
BASF Catalysts
Iselin, New Jersey



Material of Construction Selection

Key Material Selection Criteria:

- Oxidation Resistance
- Suitability for catalyst washcoating
- Joining via conventional methods
- Resistance to Chromium evaporation
- Acceptable creep strength
- Availability
- Cost

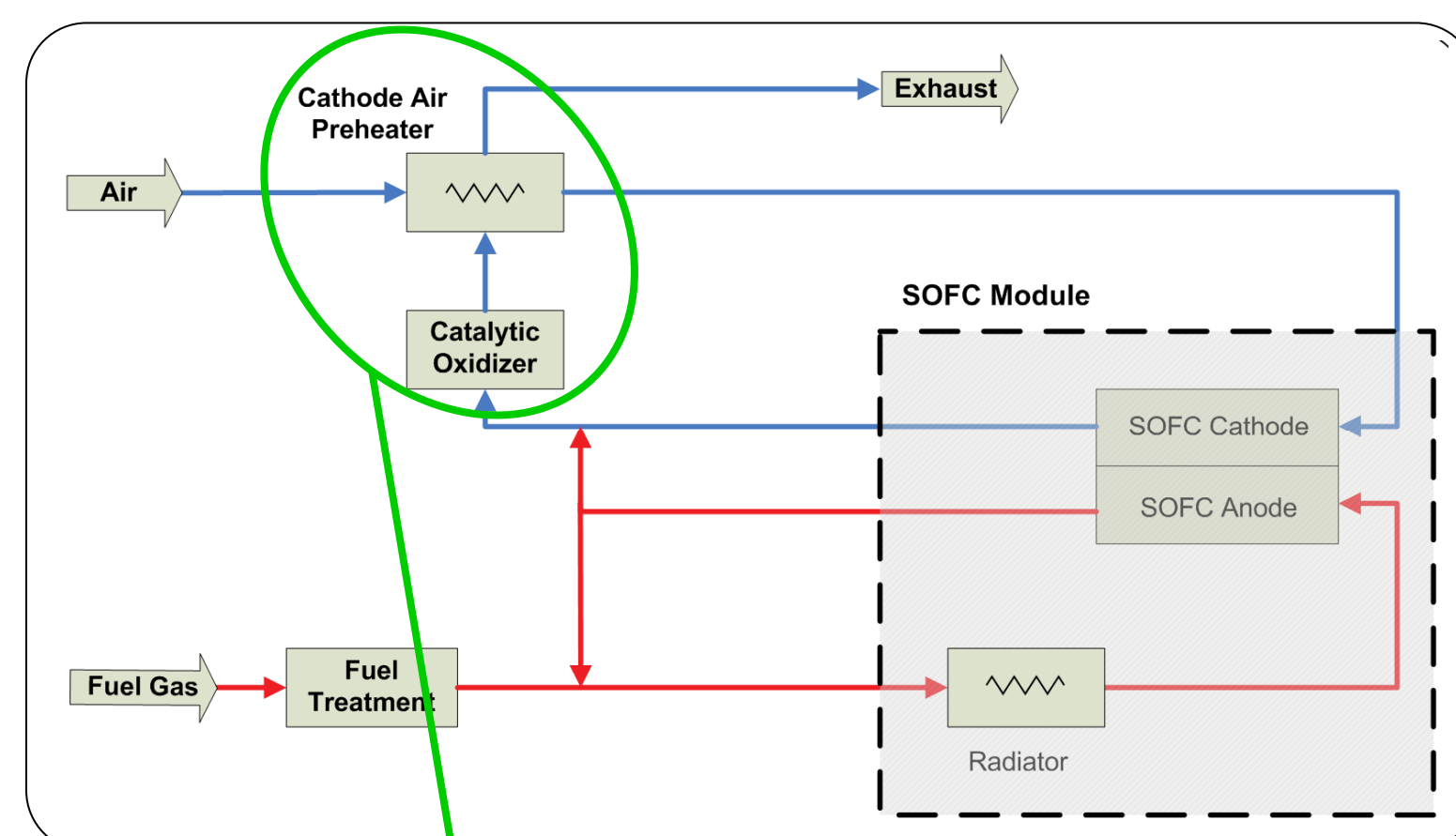


Square#	AlK[wt%]	CrK[wt%]	FeK[wt%]	NiK[wt%]
1	36.8%	12.4%	0%	50.8%
2	51.03%	2.65%	0%	46.31%
3	72.64%	16.31%	0%	11.05%
4	92.85%	7.15%	0%	0%
5	92.57%	7.43%	0%	0%
6	38.8%	11.52%	2.24%	47.44%
7	19.85%	13.69%	0.9%	65.56%
8	1.81%	17.17%	2.58%	78.44%
9	0%	16.34%	2.9%	80.76%

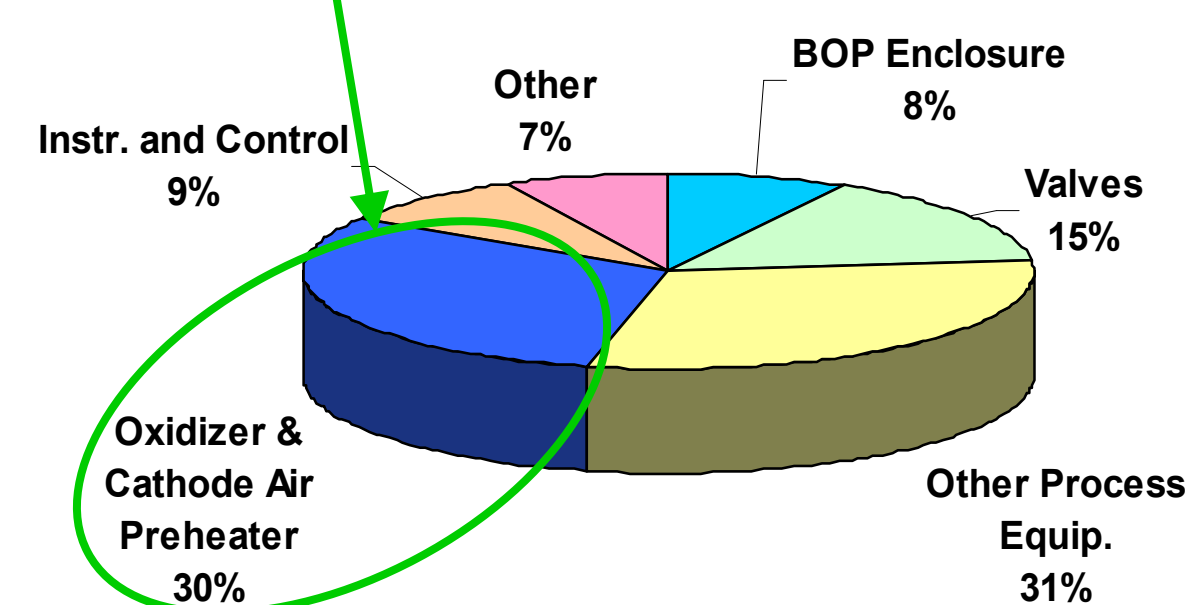
Project Background

- In addition to SOFC cell/stack performance, cost, and durability improvements – innovative technologies for reducing balance-of-plant (BOP) component costs are required for successful commercial deployment of SOFCs in distributed generation applications.

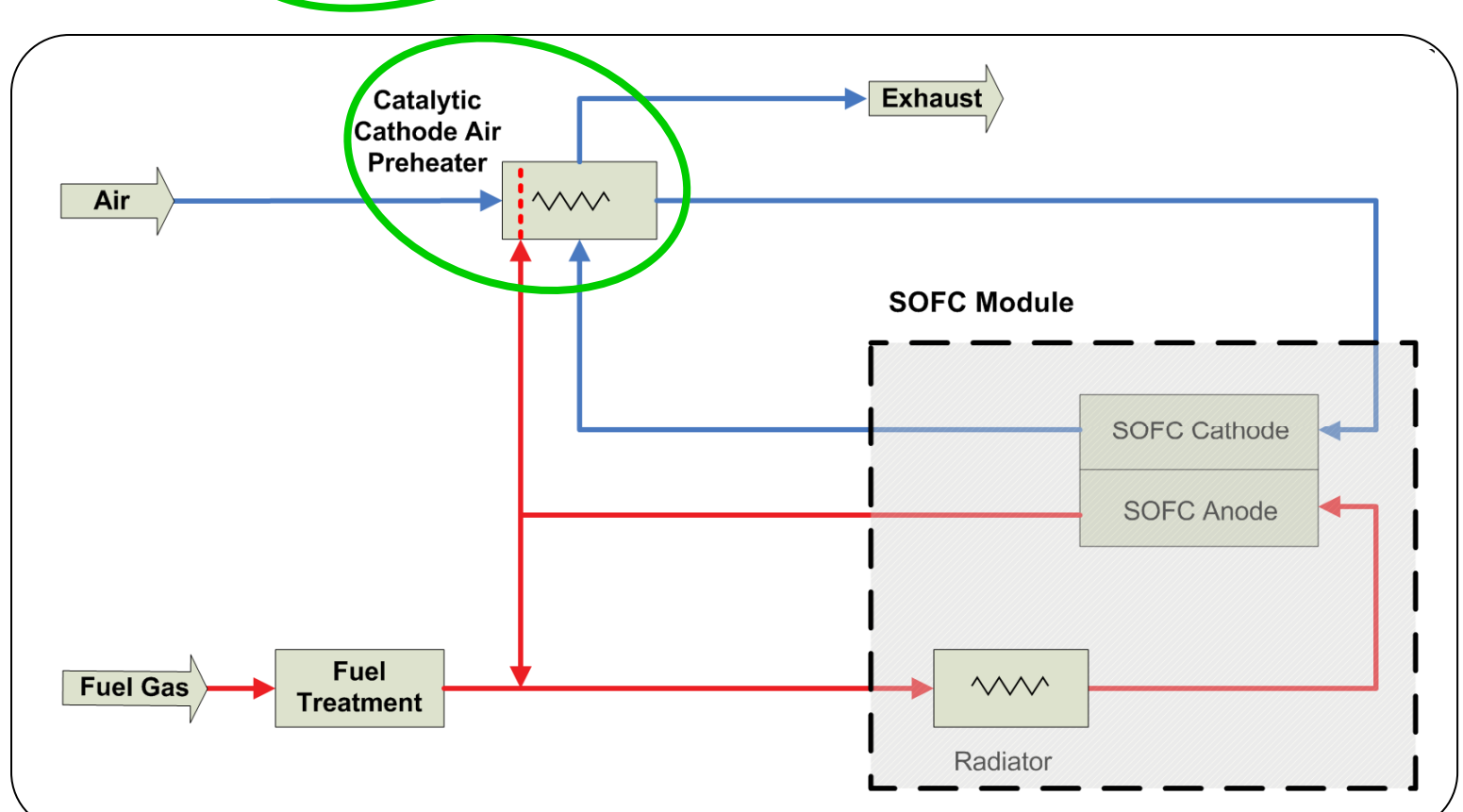
Typical SOFC-based System



BOP Capital Equipment Cost Breakdown

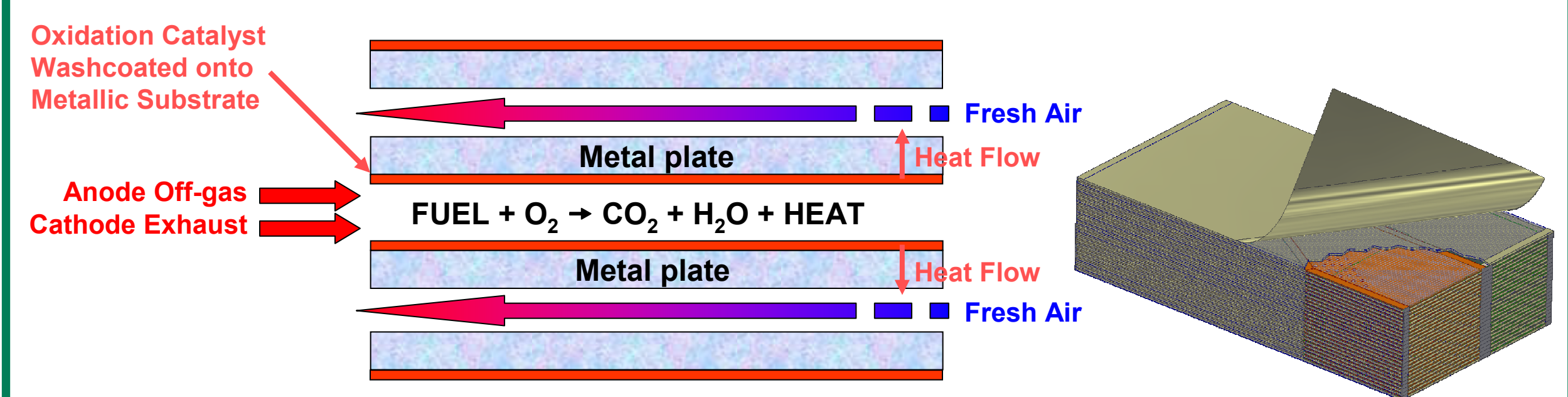


Simplified System Concept with Multi-Functional Catalytic Heat Exchanger

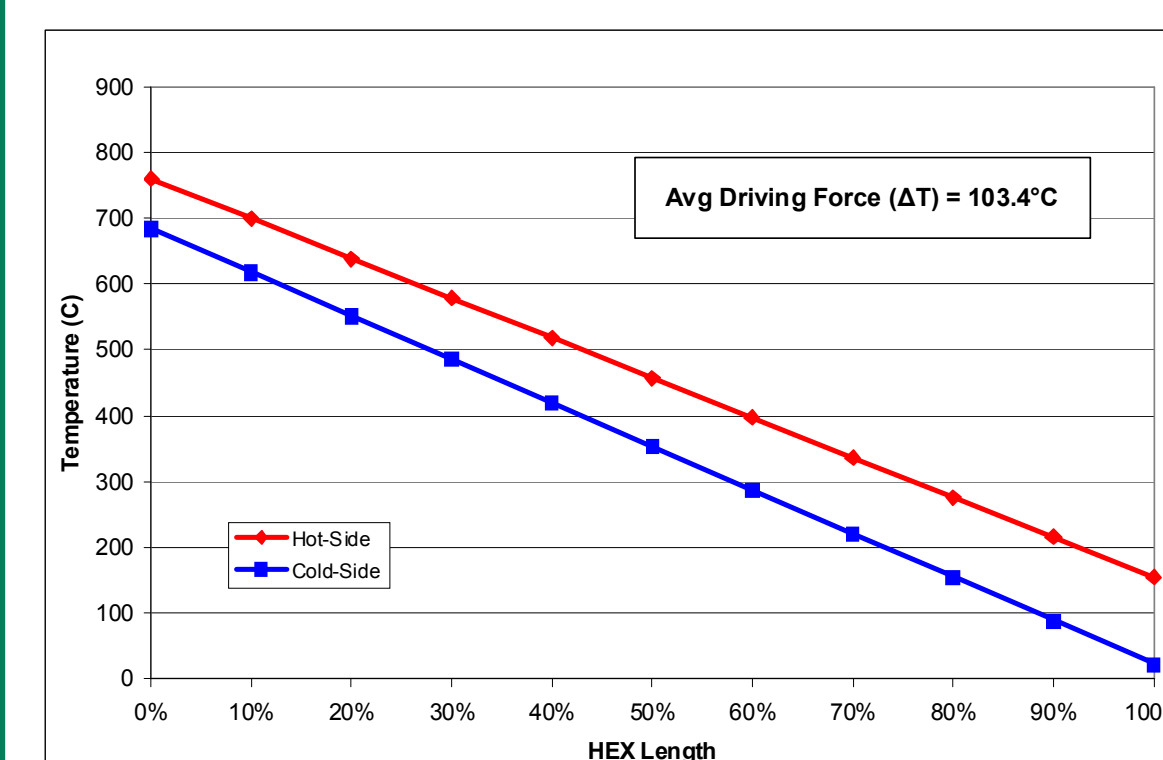


30-40% Component Cost Reduction Targeted

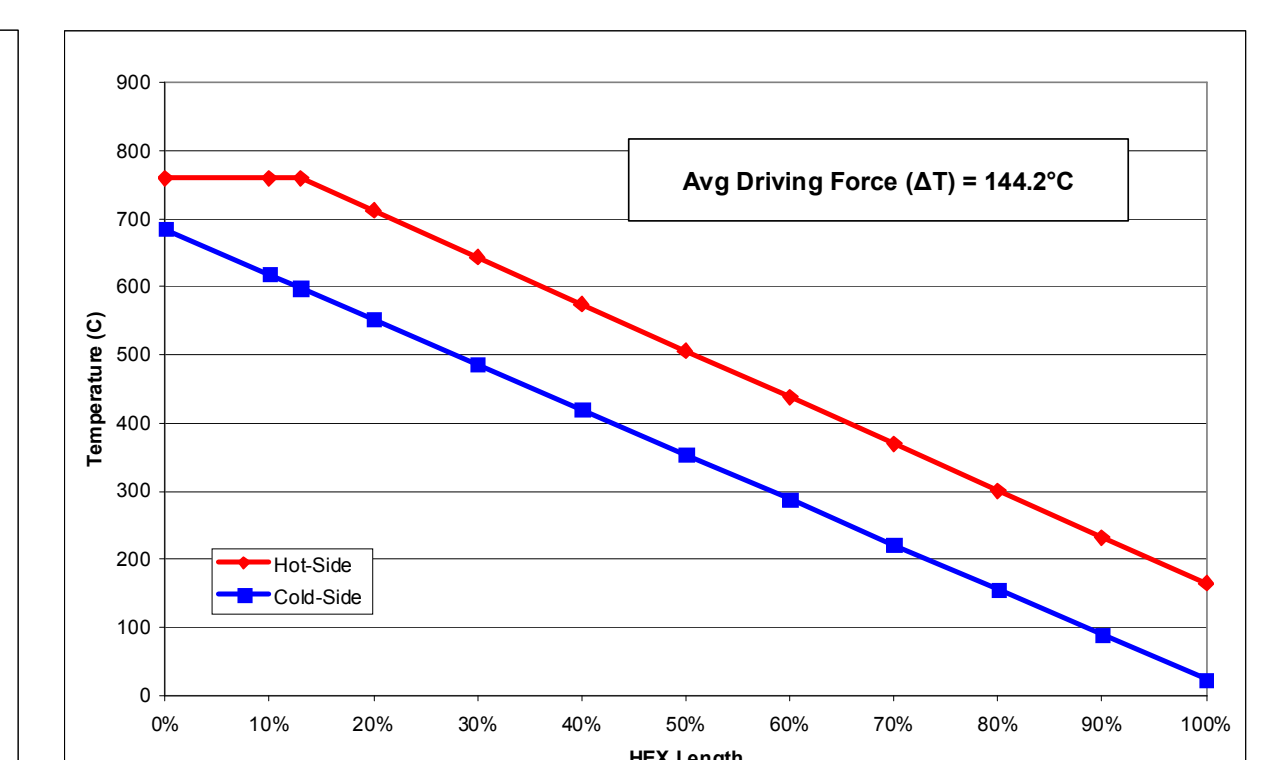
Conceptual Catalytic Heat Exchanger Design for 300kW SOFC Power Plant



Conventional non-Catalytic Heat Exchanger

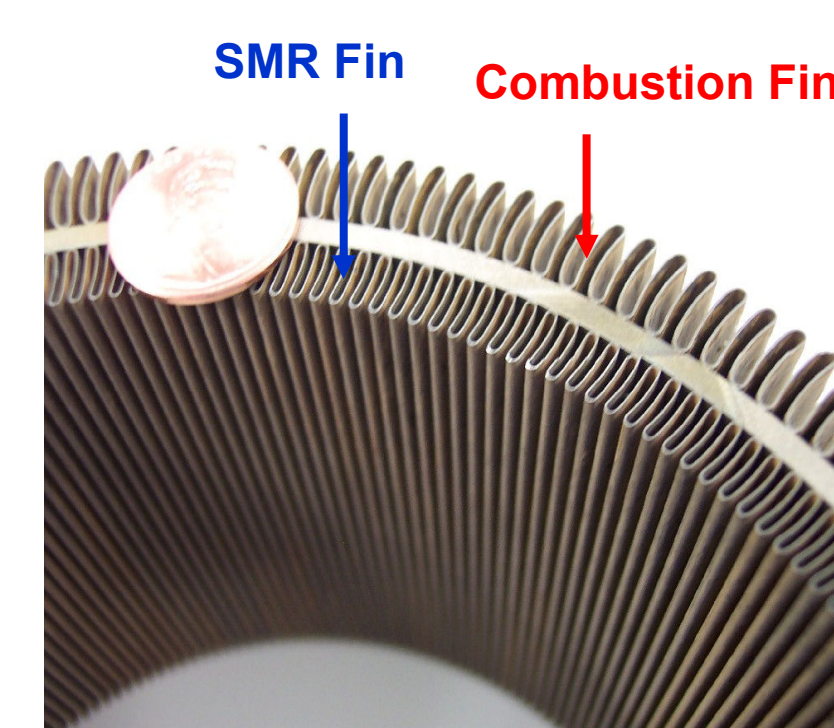


Catalytic Heat Exchanger



40% Heat Exchanger Size Reduction Possible Due to Higher Driving Force (ΔT)

Fabrication and Testing of Lab-Scale Catalytic Heat Exchanger



Photograph of a Catalytic Heat Exchanger Developed by Modine/BASF for H₂-Production from Natural Gas



FCE's Anode Gas Oxidizer Test Facility

Project Work Plan

High Temperature Materials Testing & Selection

300kW-Scale Conceptual Catalytic Heat Exchanger Design

Capital and Life-Cycle Cost Analysis

Lab-Scale Catalytic Heat Exchanger Fabrication and Testing (1-3kWt scale)



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FuelCell Energy
Ultra-Clean, Efficient, Reliable Power