Development of a Microchannel High Temperature Recuperator for Fuel Cell Systems

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Objective: Enhance the development toward ultra-high efficiency fuel cell systems (both SOFC and DFC®).

US DOE/EERE Industrial Technologies Program

DOE Contract DE-EE0001111

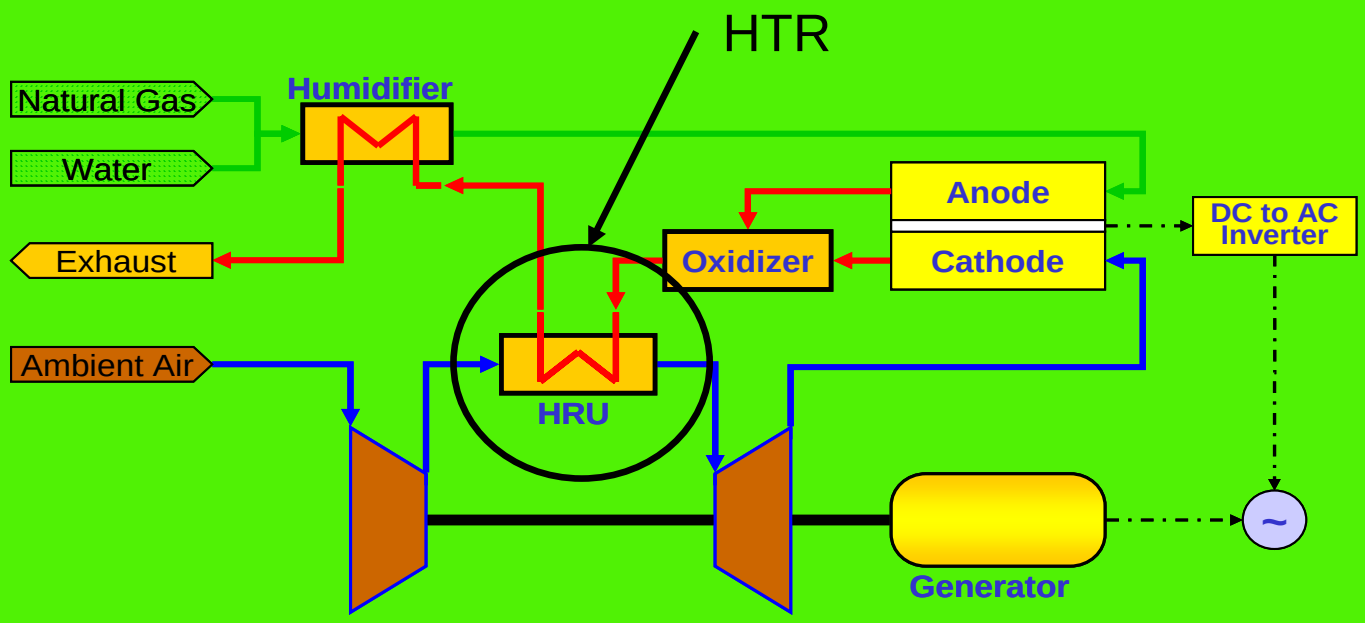
FuelCell Energy, Inc.
Danbury, CT

Pacific Northwest National Laboratory
Richland, WA

Oregon State University
Materials Institute
Corvallis, OR

Project Background

- Fuel Cell + Unfired Gas Turbine = Ultra-High Efficiency Generator
- Higher Turbine Temperature → Higher Efficiency
- High Temperature Recuperator (HTR) → High Cost



Fuel Cell/Turbine System

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Microchannel Technology

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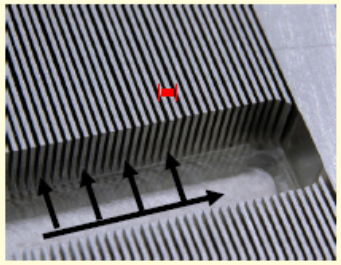
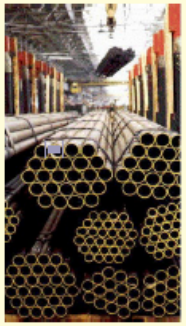
Heat Exchange in Microchannels

1 – 2 orders of magnitude reduction in hardware size



~ 0.01 inch

Vs.



~ 1 inch

- High heat transfer coefficients
- High heat transfer surface area per unit volume
- Low pressure drop achievable through short flow distance

MICROPRODUCTS BREAKTHROUGH INSTITUTE
An ONAMI Facility

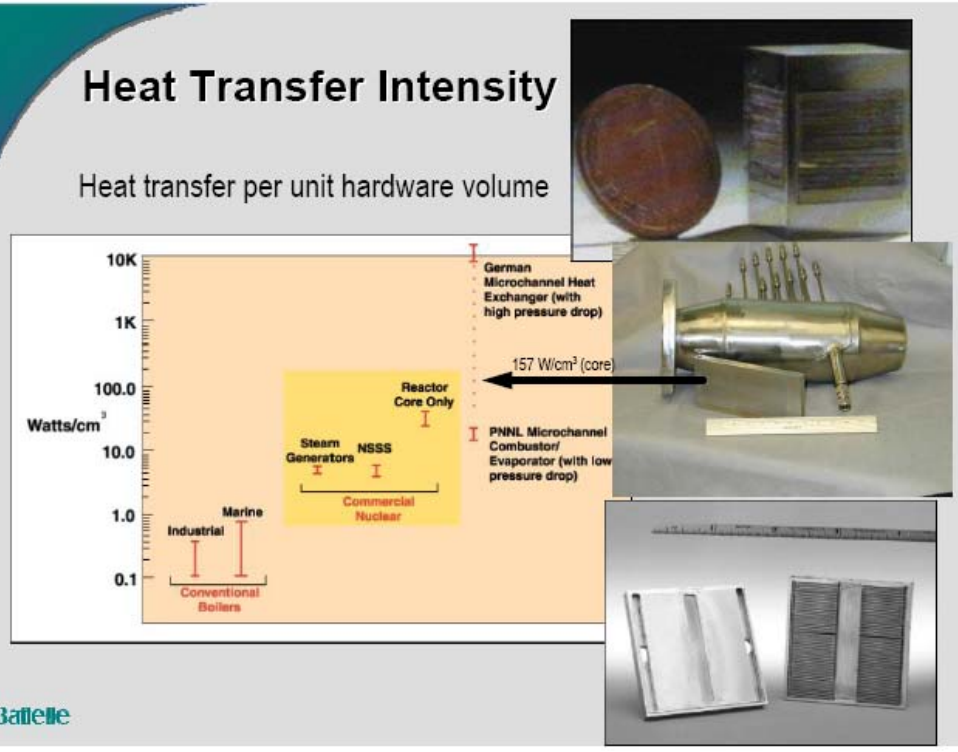
ONAMI

OREGON STATE UNIVERSITY

Pacific Northwest National Laboratory

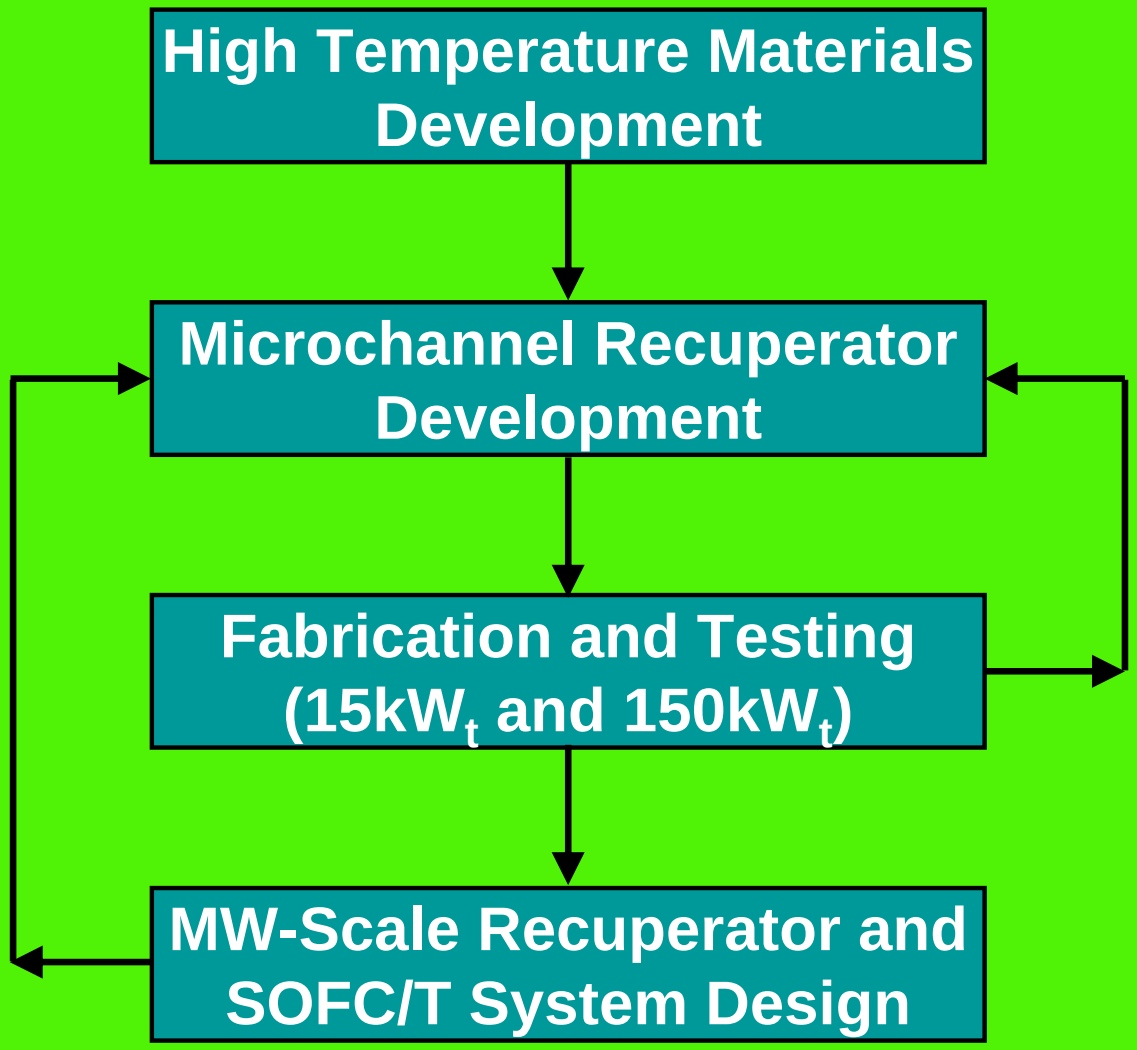
Heat Transfer Intensity

Heat transfer per unit hardware volume



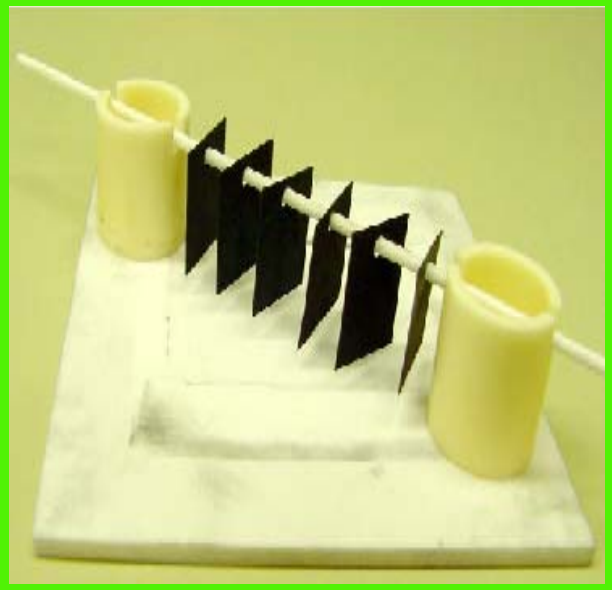
Battelle

Work Scope

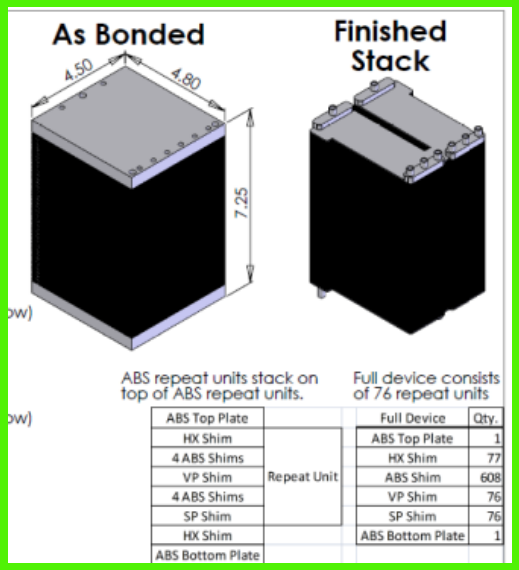

High Temperature Materials Development
Microchannel Recuperator Development
Fabrication and Testing (15kW$_t$ and 150kW$_t$)
MW-Scale Recuperator and SOFC/T System Design

Project Tasks

Task 1 High Temperature Materials Development



Task 2 Microchannel Recuperator Development



	Component	Process Choice
Pattern	ABS Top	Laser Cut
	ABS Bottom	Laser Cut
	HX	ECM
	ABS	ECM
	VP	ECM
	SP	Laser Cut
Bond	Stack	Laser Weld
Singulate	Stack	Saw
Interconnect	Headers	Form/Draw
	Interconnect	Laser Weld

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Project Tasks

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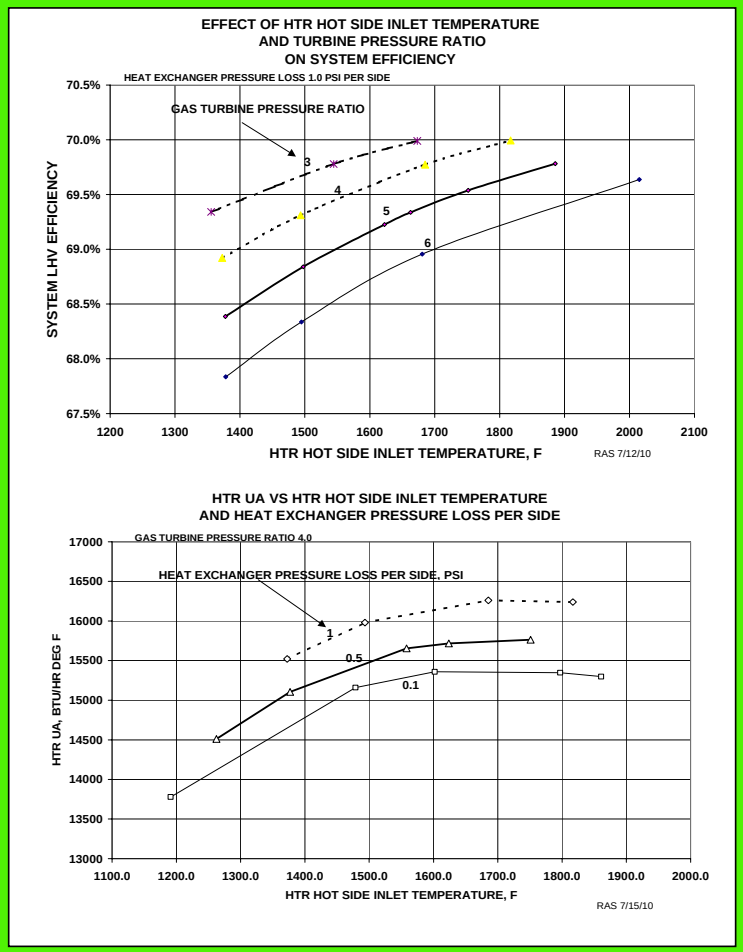
Task 3 Microchannel High Temperature Recuperator Testing

Test Facility for 15kW$_t$ SOFC/T Recuperator

Test Facility for 150kW$_t$ DFC/T Recuperator

Task 4 Scale-up Design



- System Design
- Cost Analysis
- Scale-Up to MW Level