



Fuel Processing Power Sources



S&T Campaign: Sciences for Maneuver Energy and Propulsion

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Research Objective

- Limited endurance (low energy densities) for state-of-the-art battery technology limits mobile platforms
- Investigate fuel processing power sources enabling commercial fuel cell technology to power robotic and vehicular platforms such as ATV, TALON UGV and Stalker UAV with superior endurance to current power systems

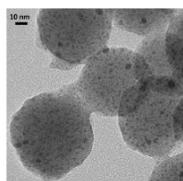


ARL Facilities and Capabilities Available to Support Collaborative Research

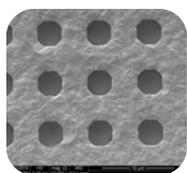
- State-of-the-art 15,000 ft² clean room used for MEMS fabrication of microstructured palladium membranes for hydrogen purification
- Fuel processing laboratory with 24 hr operation capability for long endurance system testing
- Fuel characterization with GC-MS, sulfur analysis (total sulfur content and speciation)
- LabVIEW controlled catalytic reactors, micro-GC and mass spectrometer, FTIR spectrometer with in-situ time-resolved capability, physisorption-chemisorption analyzer
- Catalytic combustion laboratory specialized in logistical fuels

Challenges

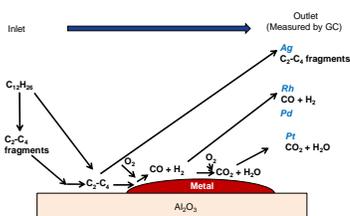
- Lack of clean hydrogen sources for commercial fuel cells
- Current hydrogen cleanup subcomponents too bulky and expensive
- Ideal hydrogen source is JP-8, but this fuel is a complex mixture of hydrocarbons with high-level sulfur contaminants



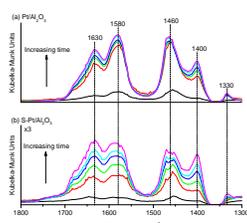
Nanomaterials for desulfurization of JP-8



Pd membrane for hydrogen purification (1 μm thick)



Surface reaction mechanism for multifuel oxidation

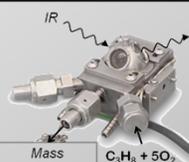


Identification of surface species during reaction

Novel, high flux, low cost Pd membrane 24/7 Fuel processing testing MEMS processing



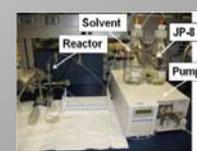
Fuel Conversion at ARL



In-situ surface science



Sulfur analysis



Absorbent screening

Complementary Expertise/Facilities/Capabilities Sought in Collaboration

- Design, modeling, fabrication and systems integration for compact membrane reactors/purifiers
- Computational calculations on desulfurization chemistry
- Modeling of surface chemistry on Pd alloy surfaces
- Sample preparation and imaging with high resolution TEM