REQUEST #RFP_2018_3944

Development Partner for High-power-density SOFCs

RESPONSE DUE DATE: February 12, 2018

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Opportunity
Joint/contract development, licensing

Timeline
1) Establish large area, full-format solid oxide fuel cells (SOFC) technology and develop the primitive concept for SOFC stack design: Within 2 years

2) Develop, evaluate, validate prototype for shorter SOFC stacks (~40 cells): Within 4 years

Financials
Budget for joint development already secured (details open to negotiation based on proposals)

DESCRIPTION
NineSigma, representing a major manufacturer, seeks a partner to develop high-power-density solid oxide fuel cells (SOFCs) stack. We are particularly looking for (a) technology to increase the size of metal-supported cells; (b) technology to prevent gas leakage from the edge of sintered porous metal substrate; (c) technology to reduce area specific resistance; and (d) repeat unit and stack design that improves the power density of stacks. The Client is willing to share, as necessary, their insights and resources with the selected partner for expediting the development. In particular, the Client has significant experience with lab-scale metal-supported cells.

KEY SUCCESS CRITERIA

Aims of SOFC stack
- Applications: cogeneration system, power supply for data center, backup power supply within plants, battery integrated transportation, etc.
- Power density: 1.5–2.5 kW/L
  - Performance per cell: 0.5 W/cm2
  - Fuel type: reformate (preferably, internal reforming)
  - Planar cell/stack

○ Temperature during power generation: 500–650°C

○ Size: Active area of approx. 200-250 cm²; height of approx. 40–50 cm

○ Superior thermal shock resistance during operation

○ Cell frame assembly meets the following:
  - Area Specific Resistance (ASR): ≤50 mohm-cm² (preferably around 10 mohm-cm²)
  - Low fuel gas leakage from the edge of sintered porous metal substrate: Preferably ≤10 mL/h of He leakage under a differential pressure of several kPa

Technology requirements

A) For larger, full-format SOFC technology:
  - The following criteria should be attained using metal-supported cells (sintered porous metal):
    - Active area: 200–250 cm²
    - Materials: ferritic stainless steel
  - The process recipe for prototype cells will be provided by the Client

B) For cell-frame assembly technology:
  - Technology to prevent gas leakage from the edge of sintered porous metal substrate:
- Sealing, densification, frame welding, etc.
  - Technology to reduce ASR:
    - Improvement in the composition, structure, and shape of interconnect materials, or their coating
    - Welding of the interconnect material and sintered porous metal
    - Improvement in the composition of the contact material and its application process

C) For cell-frame assembly stacking technology:
- Performance based design to improve the power density of SOFC stack considering the components thickness reduction and/or temperature distributions
- Structural design to achieve the above-mentioned design aims in addition to desired strengths.

**Proposer requirements**
- Evaluate the cell and stack performance
- Capacity for mass-production is not required at this point; however, a proposer should be able to prototype and supply cell and stack at research/development phase
- A proposer should preferably be able to handle the entire series of technologies under A) through C) above: however, we would welcome proposals on single elemental technologies within A-C).

**BACKGROUND**
Metal-supported solid oxide fuel cells (MS-SOFCs) has the features of excellent power generation efficiency, fuel flexibility superior start-up and thermal shock resistance. MS-SOFCs are expected to as a common choice for use in the power-generation systems for data centers and as a backup power supply and a battery to be loaded on battery integrated transportation. The Client has been working on the development of MS-SOFCs, yet their commercialization requires an even higher power density, and a breakthrough is critical in the performance of cells and stacks. Meanwhile, the development of SOFCs and their materials is widely performed around the world. The Client has therefore decided to make this RFP to further accelerate the research and development endeavors of their own selves.
• Conditions for cell/stack prototyping and sample testing (e.g. cost, period, contract terms)
• Current challenges and future development plans
• Potential for scale-up
• Past results (e.g. research papers, patents)

Please submit your proposal via NineSights, the platform of NineSigma’s Open Innovation community, which allows you to manage all your proposals. Please contact the Solution Provider Help Desk phd2@ninesigma.com for assistance about registration and proposal submission.

NOTES ON RESPONSE
Proposal shall have clear points and should not include confidential information. Supplemental files may be submitted in addition to the proposal.

RESPONSE EVALUATION
The client will evaluate all responses with the following criteria.
• Overall scientific and technical merit
• Approach to proof of concept or performance
• Economic potential of concept
• Realism of the proposed plan (action items, timeline, roles, deliverables, cost estimation)
• Potential for proprietary position
• Respondents’ capability and related experiences

ANTICIPATED PROJECT PROCESS
After the submission due date, the client will review all submitted proposals. NineSigma will send the review results to each proposer 6-8 weeks after the due date. The client possibly asks clarifying questions before selecting the most suitable candidates for collaboration. The client will select best candidates through evaluations. During the selection process, the client may execute NDA with selected respondents, seek further information disclosure, and discuss specific development targets or potential opportunities. The client will execute necessary agreements with the selected respondents and move to the advanced development phase. Specifics of any collaboration will be determined through consultation with the concerned parties.