

Plasma Catalyzed JP-8 Reformer Scale-up for Stationary MCFC Systems

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The National Defense Center for Energy and Environment (NDCEE) mission is to support DoD sustainability and readiness while reducing the footprint of military operations. Molten Carbonate Fuel Cells (MCFC) are a promising alternative to in-theater diesel fueled-generators. In-theater operations of MCFCs will most likely use JP-8, the Army and Air Force single battlefield fuel. Currently, one of the major barriers to adoption of fuel cell power generation is the size and complexity of the fuel processing system, particularly with JP-8 fuel. Ceramatec has shown promising results with its GlidArc plasma reformer, successfully reforming JP-8 at the 10kW_e-20kW_e scale with support from the Air Force, Army (TARDEC) and the Office of Naval Research. Building on these earlier programs, Ceramatec, with the support of NDCEE and the Air Force Advanced Power Technology Office (APTO), is demonstrating a 50kW_e GlidArc plasma JP-8 reformer as a first step in scaling to match the 250kW_e MCFC systems being hosted by the Air Force.

Due to our background as an SOFC developer, Ceramatec has long been a strong proponent of exploiting the high system efficiencies that can be obtained by thermal and process integration of the reformer and high temperature fuel cells compared with standalone POx reformers. However in this case, thermal and process integration with the MCFC is not an option. Therefore, the Ceramatec 50kW_e JP-8 reformer is being designed for maximum efficiency in a standalone mode, giving careful attention to steam generation, fuel vaporization, recuperation, and minimizing heat losses. The 50kW_e test article design, fabrication and operational results will be presented.