

Non-thermal Plasma Logistic Fuel Reformer for TARDEC

Ceramatec, Drexel University, and IntraMicron have constructed a non-thermal plasma reformer capable of processing Mil-Spec JP-8 (i.e. up to 3000 ppmv sulfur) into a stream of gas appropriate for a solid oxide fuel cell. The unit is being prepared for TARDEC (i.e. Tank Automotive Research, Development and Engineering Center). The plasma reformer is capable of operating in a sulfur tolerant mode so liquid phase sulfur removal or hydro-desulfurization is not required. The unit is capable of a cold start and the reformate sulfur removal system can be regenerated without interrupting system operation. The system will provide sufficient clean synthesis gas (i.e. carbon monoxide and hydrogen) to fuel ten (10) kilowatts of solid oxide fuel cells (i.e. assuming operation of the SOFC at 40% efficiency). The reformer uses the non-thermal plasma to form radicals to promote reforming much as would occur with a solid reforming catalyst. The plasma unit has the advantages of being insensitive to sulfur (i.e. it is essentially a continually renewing catalyst), creating a highly active reforming zone, being fuel flexible, and being capable of operating in a number of orientations for packaging.

This paper will present the theory behind non-thermal plasma reforming of heavy hydrocarbons, the design of the reforming system, and results of the system operation during the TARDEC acceptance test. An artist's representation of an integrated reformer and fuel cell will also be presented.