FuelCell Energy
World Leader in Ultra-Clean Power

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Stabilized Nano-ZnO for Diesel Desulfurization

As part of the marine diesel applications for the DFC®, FuelCell Energy (FCE) is currently developing advanced diesel fuel processing technologies. For automotive and military fuel cell applications, liquid hydrocarbons (gasoline, diesel, kerosene, jet fuel) are ideal fuel choices due to their higher energy density, availability, and safety for transportation and storage. However, liquid fuels usually contain sulfur compounds that are poisonous to reforming catalysts used for hydrogen generation as well as the fuel cell electrode catalysts. Although research efforts to date have advanced the technology for logistic fuels processing significantly and developed a working system which was demonstrated in a 500 kW demonstrator, substantial improvements to reduce size, and weight beyond the state-of-the-art are required for DoD applications.

Desulfurization of logistic fuels is accomplished in two stages: Stage 1 is the conversion of the organic sulfur compounds to hydrogen sulfide (H_2S) and Stage 2 is sulfur capture, where the H_2S is captured on a sorbent to provide sulfur free fuel to the fuel cell. Presently, conventional ZnO based sorbents are used to trap the sulfur in logistic fuels. The objective of this Office of Naval Research (ONR) funded program is to develop high capacity Nano ZnO desulfurization sorbents for diesel desulfurization for ship service fuel cell (SSFC) applications. Theese advanced sorbents significantly reduce desulfurization processor size and weight by virtue of their capacity for higher sulfur loading. .

During the first phase of the program it was determined that commercially available, high capacity Nano ZnO resulted in a sorbent bed that was half the size and weight of a conventional ZnO sorbent bed. In the second phase of the program FCE will investigate the benefits of using a polishing bed of Nano ZnO fibers . The desulfurization system will also be tested under simulated auto-thermal reforming conditions.

Once the optimum bed configuration is determined, a Nano ZnO bed sized for a 50kW fuel cell will be constructed for operation at the Navsea test facility in Philadelphia, PA. In addition, a conceptual 625kW Nano ZnO bed will be designed.