Conversion of hydrocarbon fuels, such as gasoline, methanol, and diesel fuel by reforming is an attractive alternative for onboard production of hydrogen to reduce vehicular emissions. The successful development of a fuel cell-powered vehicle depends on the development of a reliable fuel processor. The choice of the reforming reaction mode in the fuel processor depends on the operating characteristics of the application (like varying power demand, rapid startup, frequent shutdowns) and the type of fuel cell stack (PEMFC or SOFC).

The present experimental study has been undertaken in order to investigate the effect of catalyst preparation on the steam reforming of dodecane and hexadecane, which are selected as diesel and jet fuel surrogates. Quaternary and ternary aerogel catalysts were prepared by the sol-gel method. Nickel and cerium precursors used were in nitrate as well as acetate form; ruthenium precursor was in chloride form. For the aluminum precursor, aluminum tri-sec-butoxide (ATB) was used. The following sol-gel parameters were varied during the synthesis: nickel content= 4-15%, ruthenium content= 0-1 wt%, ceria content=3 to 20 wt %. For comparison purposes, catalysts of the same composition were prepared by impregnation on either alumina xerogel or commercial γ-alumina. They were characterized by X-ray diffraction (XRD), temperature-programmed reduction (TPR), temperature-programmed oxidation, pore size distribution, and BET surface area measurements. The steam reforming of dodecane and hexadecane was investigated in a microreactor setup at different reaction temperatures, space velocity and steam/carbon ratio. The aerogel catalysts exhibit unusual physical and chemical properties, as manifested in very large specific surface area, well-defined pore size distribution and good textural stability when compared to the conventional impregnated catalysts.

The results from the microreactor experiments and catalyst characterization will be presented and the effect of the catalyst preparation on the hydrogen yield, carbon formation and product gas composition will be discussed.