

**The principal objectives of the CFFLS C1 research program:**

- Develop technology for conversion of C1 source materials (natural gas, synthesis gas, carbon dioxide and monoxide, and methanol) into clean, high efficiency transportation fuel, especially diesel fuel.
- Develop improved processes to convert natural gas into syngas.
- Develop new processes for producing hydrogen from natural gas and other hydrocarbons.

A further general goal is to develop improved understanding of catalytic reaction mechanisms for all of these processes.

**Summary of the principal accomplishments of the research program during its first year:**

- Fischer-Tropsch fuels containing oxygen have been synthesized.
- Higher ethers (C6-C8) have been synthesized from olefins, methanol and ethanol.
- Dimethyl and diethyl carbonates have been produced from the reaction of methanol and carbon monoxide.
- A small diesel engine has been set up to test the effects of these fuels, either alone or as additives, on particulate matter emissions and cetane level.
- Nanoscale, binary, Fe-based catalysts have been shown to have significant catalytic activity for the decomposition of methane to produce pure hydrogen.
- An environmentally safe catalyst for the hydroisomerization of straight-chain alkanes has been developed that may be useful for producing low pour point diesel fuel from F-T wax.
- Work on CO<sub>2</sub> reforming of methane to synthesis gas has been initiated.
- The reaction of CO<sub>2</sub> with ethylbenzene to produce styrene, which is a high volume, high value chemical, appears to a promising method of utilizing a greenhouse gas.
- In situ measurement capability has been developed for several analytical techniques to allow determination of catalyst structures and product suites during C1 reactions.