Direct Liquefaction of Coal using Natural Gas

Coal liquefaction is one method to potentially increase use of the U.S. liquid fuel supply. The considerable expense of hydrogen production is one of the significant drawbacks to commercial coal liquefaction technology. CAER researchers have developed a novel approach to fuel production using natural gas. Commercialization of this technology has been planned after successful catalyst development and once reasonable oil yields can be obtained.

CH$_4$ + Coal $\rightarrow$ Fuel

Process Description

Catalysts are being evaluated using a pressure reactor to determine the required temperature of reaction and product compositions. The gas products are collected and quantified by GC-TCD. Liquid products are extracted in THF or ethyl acetate to determine the yield. Further, the liquid products are extracted in toluene and hexane to determine the asphaltene and preasphaltene yield. Oil purification, quality, and process economics are also being established at CAER.
Benefits of the proposed technology

- Abundant low cost feedstock.
- Low CO2 emissions as compared to indirect coal liquefaction.
- Elimination of hydrogen generation step as is conventional.
- Reduced energy inputs and increased reaction rate.
- More liquid yield as it is more of alkylation type rather than hydrogenation type.
- Simple and more economical process than hydrogen based processes.
- Much lower cost compared with commercial hydrogen based liquefaction operation.