**Plan B: Taking the Carbon out of Fossil Fuels**

**with Catalytic Reactive Separation**

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There is no evidence that significant reductions in the carbon dioxide emissions associated with power generation will be cost effectively achieved using current commercial alternatives to abundant and inexpensive fossil fuels. Clean burning hydrogen has long been considered the fuel of the future, however, cost-effective production methods have not been proven. Technoeconomic comparisons of electrolysis, steam methane reforming, and pyrolysis shows that the lowest cost process for producing hydrogen and/or dispatchable electricity without CO2 emissions can utilize pyrolysis of abundant, natural gas. The challenge is to achieve high methane reaction rates and high conversion to molecular hydrogen in a reaction environment where solid carbon can be continuously separated. Reactive separation using high temperature (~1000 oC) catalytic complex liquids has been investigated in several multiphase reaction systems and high rates (>1 mole/m3-s) of methane decomposition and high selectivity for molecular hydrogen observed. When the physical properties of the liquids are selected optimally, conveniently separable solid carbon is produced from methane dehydrogenation in bubble column reactors. Solid catalysts in specific melts may also be continuously reactivated as the high temperature liquid serves as a solvent to remove carbonaceous surface deposits prior to the irreversible formation of deactivating coke. Single pass methane conversion of over 95% to molecular H2 at over 98% selectivity is demonstrated in complex melt systems. Process designs for solid carbon synthesis with zero carbon hydrogen and/or electricity production together with relative technoeconomics will be presented.