A NEW OUTLOOK ON COAL LIQUEFACTION THROUGH SHORT CONTACT TIME THERMAL REACTIONS -- CHEMICAL FACTORS WHICH LEAD TO HIGH REACTIVITY, D. D. Whitehurst, Mobil Research and Development Corporation, P. O. Box 1025, Princeton, New Jersey 08540

In the presence of certain solvents and at elevated temperatures (~400°C), coals can be transformed to soluble products in high yields in less than 5 minutes. This observation has led to a number of potentially new coal liquefaction processes.

The ease of coal transformation is dependent on the chemical and physical nature of the coal and the chemical nature of the solvent. Contrary to past reports, the rate of coal solubilization was observed to be dependent on the hydroaromatic content of the solvent. With a solvent having limited hydroaromatic content, maximum conversions were observed for coals having ~85% carbon (maf). High conversion was associated with low hydrogen consumption.

High reactivity was found to be associated with coals which swell with solvents or become plastic easily. The significant chemical properties of highly reactive coals were observed to be an intermediate aromatic carbon content, and the presence of $Ar-CH_2-$ or $ArCH_2-CH_2-Ar$ groups.

POTENTIAL OF FURTHER CONVERSION OF SHORT CONTACT TIME SOLVENT REFINED COALS BASED ON CHEMICAL STRUCTURE. M. Farcasiu. Mobil Research and Development Corporation, Central Research Division, P. O. Box 1025, Princeton, New Jersey 08540.

Chemical structures present in short contact time solvent refined coals are different from the corresponding long contact time liquefaction products. The differences will be presented in a comparative way for both bituminous and subbituminous coals. The short contact time products contain comparatively more hydroaromatic structures and phenolic groups, but are similar in molecular size to the long contact time products. The implication of these structural features on further upgrading of the products and on possible regressive reactions should be considered in connection with choosing the right parameters: temperature, pressure, solvent and catalyst for further processing. A discussion of the thermodynamic constraints due to the chemical structures present in short contact time liquefaction products will be also presented.

UPGRADING OF SHORT CONTACT TIME SOLVENT REFINED COAL. R. H. Heck, T. O. Mitchell, T. R. Stein and M. J. Dabkowski. Mobil Research and Development Corporation, Central Research Division, P. O. Box 1025, Princeton, New Jersey 08540.

In the production of Solvent Refined Coal for use as a solid low sulfur boiler fuel, the residence time of the coal in the dissolver is dictated by the desired sulfur content of the SRC product. The coal can, in fact, be liquified at significantly shorter dissolver residence times. This short contact time (SCT) operation results in significantly lower gas make and hydrogen consumption for the SRC process.

SRC from the SCT operation contains more sulfur and oxygen than conventional SRC from the same coal. It also contains a much higher fraction of high molecular weight, highly polar asphaltenic molecules. Both thermal and catalytic upgrading of SCT-SRC were investigated. Thermal treatment reduces the molecular weight, functionality and heteroatom content, but is accompanied by excessive gas make and a decrease in product hydorgen content. However, catalytic hydroprocessing results in a significantly higher quality liquid product with a minimum of light gas production.

The use of a SCT-SRC process coupled with hydroprocessing of the SRC product provides an efficient route for producing high yields of high quality liquid fuels from coal.

PROCESSING SHORT CONTACT TIME COAL LIQUEFACTION PRODUCTS. W. C. Rovesti and H. E. Lebowitz. Electric Power Research Institute, 3412 Hillview Avenue, Palo Alto, California 94303

The authors believe that there are substantial practical applications to the use of the primary coal liquefaction products (i.e., made at short contact times) as an intermediate in the production of clean solid and liquid fuels from coal. The theme of these applications is selective treatment of the primary products to meet specific end-product requirements. Traditional coal liquefaction practice has tended toward combination of the initial liquefaction, product upgrading, and recycle media generation into a single reaction step.

A key element in the envisioned process applications is the Kerr-McGee Critical Solvent Deashing (CSD) Process. The primary liquefaction effluent is quite viscous and would be a poor candidate for filtration. Further, process solvent is imbibed in the products and cannot be recovered for recycle by vacuum distillation. Data are presented in which the CSD unit has been used to recover the ash free vacuum resid product and imbibed process solvent. In addition, the streams have been generated for internal recycle and catalytic upgrading.

Continuous bench data are presented on short contact time liquefaction of bituminous and subbituminous coals. Pilot plant data are also presented.