SEARCH FOR A NEW COAL TECHNOLOGY. Frank C. Schora, Institute of Gas Technology, 3424 South State Street, Chicago, Illinois 60616.

Since the beginning of a coal industry, technology — other than for combustion — has evolved through the steps of devolatilization, gas production by the reaction of hot cokes with steam, and lately, coal hydrogenation for the production of both liquids and gaseous fuels. Much of the research today in the United States is dedicated to improving these present concepts and to the development of supporting steps necessary for commercialization. In the midst of these activities, one should not overlook the need for intensive research to uncover better techniques for conversion of coal — techniques which will take advantage of the structure and chemistry of coal so as to yield useable products without undergoing the severe conditions which have been the basis of our technology in the past. New coal technology should seek to allow production of liquid and gaseous hydrocarbons by controlled reactions which avoid the rapid and uncontrolled polymerization of intermediate products to coke.

FREQUENCY OF CROSS-LINKS AND MOLECULAR WEIGHT DISTRIBUTIONS IN COALS. Jeffrey Kovac and John W. Larsen, University of Tennessee, Chemistry Department, Knoxville, Tennessee 37916

Coals may be mixtures of cross-linked macromolecules. Information on the average molecular weight of the chain segment between cross-links can be obtained from equilibrium solvent swelling measurements using the Flory-Rehner equation as well as from the plastic deformation properties of coals using the Gaussian model for the elastic modulus of polymer networks. Attempts to develop a simple non-Gaussian theory of a polymer network which should be a more reasonable model for coal will be described. The average molecular weight per cross-link calculated using the above techniques will be compared with data obtained from solubilized and depolymerized coals. The implications for various coal structure models will be discussed.

GASIFICATION AT VERY HIGH HEATING RATES. C. W. von Rosenberg, Jr., D. B. Northam and R. E. Gannon, AVCO Everett Research Laboratory, Inc., 2385 Revere Beach Parkway, Everett, Massachusetts 02149

Large yields of volatile matter and high throughput for gasifiers are two notable benefits of subjecting well-dispersed aerosols of pulverized coal to large rates of heating (>10^5°K/sec) to high temperatures (>1500°K). This central theme forms the basis of several investigations at AERL which seek to explore this frontier, understand the basic processes involved and apply this approach to gasifier development. Recent experimental data from our "controlled explosive gasification" program are given and related to prior work on rapid heating entrained bed reactors and to our concurrent "shock heating studies." In a single pulse/batch process reactor of 12 litre volume we dispersively premix −200 mesh HVA bituminous coal in suitable mixtures of H_2-CO-O_2. Ignition leads to explosive combustion of the gas mixture which provides a background of hot H_2O, CO_2 and attendant radicals which then heat the coal, stabilize the evolved volatiles, and react with the nascent char. Large yields of stabilized volatiles at high solids mass loading have been achieved. Proposed gasification processes based on this approach will be discussed.

RISER CRACKING OF COAL TO OIL AND GAS. Dennis A. Duncan, Justin Beeson, Donald Oberle, Institute of Gas Technology, 3424 South State Street, Chicago, Illinois 60616.

A four-year program is under way at IGT under ERDA/FE sponsorship to develop a practical hydrocarbonization or hydropyrolysis processing scheme based on an entrained-flow reactor similar to the Riser reactors used in refinery catalytic cracking. The reaction products are gasoline, gas, fuel oil and char.

Hydrogen and coal are reacted in entrained flow at pressures in the 1000 to 2000 psi range and at temperatures up to 1500°F. Such parameters as hydrogen concentration, hydrogen preheat temperature, coal particle size, reaction temperature history, residence time and the use of other carrier gases, will be explored to establish their effect on product yields and overall economics.

A bench-scale unit is being operated now to obtain engineering design parameters. A 100 pound per hour process development unit (PDU) will be designed, fabricated, and operated later in the program.