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INVESTIGATION OF THE RANK DEPENDENCE OF TAR EVOLUTION

CONTRACT NUMBER: DE-AC22-89PC89759

QUARTERLY REPORT FOR PERIOD: 1 July 1990 - 30 September 1990

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CONTRACT PERIOD: Sept. 22, 1989 - June 22, 1991

EXECUTIVE SUMMARY

The following report contains results obtained for the third quarter period, 1 July - 30 September, 1990, of contract DE-AC22-89PC89759 entitled "Investigation of the Rank Dependence of Tar Evolution." These results are from the investigation of the nitrogen evolution behavior of a thermally stable, polyimide polymer. Elemental composition and infrared absorbance characterization of the polyimide are given relative to the parent coals investigated. The H, C and O contents of the polyimide are noted to position it well off the coalification band plot of the parent coals but in a location that can be occupied by devolatilized and partially oxidized chars. As a result, its nitrogen evolution behavior is expected to reflect the nitrogen evolution behavior of coal char samples in the latter stages of devolatilization or the nitrogen evolution behavior of bituminous coal char samples formed from alkaline-leaching beneficiation processes.

Despite its high nitrogen concentration levels relative to the parent coal samples, 7.2% vs. 1.4 - 2.0%, little volatile nitrogen evolution is observed until decomposition temperatures of 600°C or greater are obtained. Due to the lack of decomposition via tar evolution and as contrasted to parent coals, no significant bound nitrogen is evolved with heavy hydrocarbons at particle temperatures less than 600°C. Similar to "virgin" chars and tars formed during rapid devolatilization, the polyimide samples begin to evolve significant fractions of bound nitrogen as IR-active light gases at particle temperatures between 650 and 750°C. Unlike coal samples, however, relatively large fractions of the light gases are observed to be ammonia. The IR-active, nitrogen-containing light gas evolution rapidly declines at polyimide char temperatures greater than 750°C, again in contrast to observed behavior in virgin coal char samples. It is not certain if the nitrogen evolution kinetics changes from selectively forming ammonia and hydrogen cyanide to benzonitriles or free nitrogen at these temperatures.

The light gas evolution pattern with decomposition temperature of polymide could contribute to our understanding of the low conversion efficiencies observed for bound nitrogen to NO_x conversion in the char combustion phase of pfc combustion. Such a change in reaction selectivity could also account for the low levels of bound nitrogen to NO_x evolution observed in high temperature, high intensity combustion of micronized coal or alkaline-leached, beneficiated samples. The initial phase of polyimide nitrogen evolution behavior as NH_3 and HCN appears to have kinetic parameters similar to that of the high temperature secondary cracking reactions of primary tars and chars. It is characterized by an activation energy around 65 kcal.

PROJECT DESCRIPTION

Objectives:

The objectives of this study are to develop an improved understanding of the process of coal tar evolution, its relationship to the structural characteristics of the parent coal, and the dependence of the chemical and physical properties of the tar products on the conditions of devolatilization. Data from this study are expected to allow hypothesis testing and refinements of coal devolatilization models relevant to the pulverized coal combustion process.

Program Structure:

The program is divided into seven major technical areas in which the following rank dependence issues are addressed:

1. tar evolution rates in rapid heating conditions;
2. molecular weight and vapor pressure characteristics of tars;
3. chemical structure and calorific values of tars;
4. influence of interphase mass transport phenomena;
5. gas phase secondary reactions of "primary" tars;
6. parent coal nitrogen evolution during devolatilization;
7. model hypothesis testing.

The PSOC 1451D coal is the reference coal, that is, its structural characteristics and tar evolution phenomenology become the defined references for the other coals. Parent coal structural parameters, tar yields, chemical and physical properties of tars, nitrogen evolution behavior, and global kinetic parameters are defined relative to it.

Coal Characterization:

A range of coal ranks, from a Texas lignite to a Pennsylvania anthracite, are employed in the investigation. In addition, a high temperature polymer, a polyimide, is utilized as an additional reference case. The polyimide serves as a truly polymeric reference material for examining the nitrogen evolution behavior of coal. The samples are subjected to elemental composition determination (Table I), infrared absorbance characterization, calorific value measurement, high temperature ash analysis, and maceral composition. Consideration is being given to NMR analysis as well as tetrahydrofuran (THF) solubility.

Experimental Measurements:

Potential tar yields are determined by long hold time heated grid investigations of each coal at a final temperature and heating rate observed to maximize tar yields for the reference coal. Relative tar evolution kinetic behavior is determined by zero hold time heated grid (1) investigations of each coal.

"Primary" tar samples are obtained by collecting tar samples from rapid heating of parent coal samples in the UTRC entrained flow reactor and aerosol separation systems (2). Volatility and molecular weight characteristics of these samples are determined by heated grid revaporization experiments (3) and compound-type calibrated GPC examination of the tars. The compound-type calibration curve employed for each tar type is determined by elemental composition and IR absorbance measurements of each tar type to determine which calibration compound, homologous series most resembles the structural characteristics of the collective tar sample.

Gas phase secondary reactions of "primary" tar samples is investigated by comparing light gas evolution behavior in the heated grid, entrained flow reactor and flash lamp reactor systems.

Nitrogen evolution behavior is a result of the tar evolution properties of a coal and the secondary reaction chemistry of the residual char and evolved tars. Nitrogen balance determinations are made on two of the reactors – heated grid and entrained flow – directly (4) and the flash lamp indirectly. In addition to the reference behavior of PSOC 1451D, the nitrogen evolution behavior of a high temperature polyimide in rapid heating thermal decomposition conditions is investigated to serve as a truly polymeric reference.

EXPERIMENTAL RESULTS

Rationale for High Temperature Polymer Investigation:

An aromatic, nitrogen-containing high temperature polymer was selected for co-investigation with the parent coal samples for several reasons:

a.) An appreciable number of models of coal devolatilization use polymer structural concepts as the bases for describing the thermal decomposition process of coal devolatilization;

b.) The kinetics of fuel bound nitrogen evolution during the late stages of HVA coal devolatilization is simulated by the nitrogen evolution behavior of nitrogen-containing, aromatic polymers;

c.) The nitrogen evolution behavior of low rank coals, which are highly cross-linked, may be approximated by the nitrogen evolution behavior of polymeric analogs;

d.) The nitrogen evolution behavior of alkaline-leached, beneficiated coals may be closely approximated by the nitrogen evolution behavior of nitrogen-containing, aromatic polymers.

Low rank coals are known to be more highly cross-linked via oxygen functionalities than middle rank coals. Middle rank coals become highly cross-linked during the tar evolution process. Relative to their original coalification band positions, middle rank coals that have been alkaline-leached at moderate temperatures are known to become highly cross-linked and aromatic and displaced off the coalification band to positions near that of high temperature, thermally resistant polymers. By investigating the pyrolysis behavior of an aromatic high-temperature polymer, the rank characteristic and extent of devolatilization dependencies of the fuel bound nitrogen evolution behavior of coal should become more clearly delineated. Such a delineation is necessary for practical, global kinetic parameters for fuel bound nitrogen evolution to be established.

Polyimide Sample Characteristics Relative to Parent Coals:

Elemental Composition

The elemental composition results obtained for the particular polyimide samples selected for the investigation are given in Table I. The composition values of the parent coals investigated in the study are also given for completeness. Relative to the HVA reference coal, the polyimide sample is noted to be displaced toward higher O/C ratios and lower H/C ratios (Figures 1, 2). As HVA and lower rank coals devolatilize, the compositional path of the residual chars follows the path indicated in Figure 1. Consequently, at the compositional point where the main phase of particle mass loss is complete, the residual char might be expected to have fuel bound nitrogen evolution patterns similar to the polyimide model compound. In addition, many HVA parent coals are chemically modified by alkaline-leaching demineralization processes to points on the coalification band near that of the polyimide samples. Experimentally, investigating the nitrogen evolution behavior of a polymer such as polyimide is facilitated by the high nitrogen content relative to coals, ~7% versus ~1.5 - 2%.

Figures 3, 4, 5, and 6 display the IR absorbance spectra of the polyimide sample and lignite, HVA and low volatile bituminous coals respectively. The sharp absorbance band structure of the polyimide is in distinct contrast to the broadband absorbance characteristics of the coal spectra. The difference in absorbance spectra characteristics result from the fact that the polyimide is a relatively pure substance compared to the coal matrices, which consist of a wide range of molecular types and sizes. In addition, the coal IR spectra indicate significant degrees of hydrogen bonding interaction among the highly polar molecular components of the coal matrices, as evidenced by the severe broadening of the hydroxyl and amine absorbance bands throughout the 2000 to 3600 cm^{-1} regime. From an elemental composition point of view, the polyimide has characteristics of a hydrocarbon-devolatilized (thermally or chemically) coal char but, from an IR absorbance point of view, it has the characteristics of a single component substance.

Heated Grid Devolatilization Behavior of Polyimide

Previous reports (5, 6) and publications (1) provide details of the operation of the UTRC heated grid (UTRC-HG) reactor. Table II contains the details of the runs performed with the polyimide samples utilized in this investigation. Product distributions and the elemental composition of the major product, polyimide char, are provided in the table. Only relatively long hold time runs were performed with the polyimide samples. Due to its thermal stability at temperatures less than 600°C, relative to coal samples, zero hold time transient heating experiments were not performed.

Major Product Distributions and Temperature Dependencies:

Relative to Reference Coal, PSOC 1451D

Figure 7 displays the major product distributions of the polyimide samples heated as indicated in Table II. Figure 8 displays the analogous data for the reference HVA bituminous coal. PSOC 1451D. The differences in mass loss product distributions with respect to peak temperatures are appreciable. The polyimide produces no significant condensible tars until peak temperatures of greater than 650°C are achieved and then only when rapid heating to such temperatures is utilized (7). Relative to a bituminous coal, the polyimide polymer is thermally quite stable and displays no tar evolution in the 300 to 600°C temperature range.

Low levels of light gas evolution are observed from polyimide at temperatures between 500 and 550°C. These gases are primarily CO_2 and CO (Figure 9). Methane evolution from the polyimide (Figure 10), the only detectable noncondensible hydrocarbon, is associated with the main phase of mass release, which occurs between 650 and 800°C. In these moderate heating rate conditions, bituminous coals display low levels of CO, CO_2, CH_4, C_2H_6 and higher hydrocarbon release during the main, low temperature, tar evolution phase. The most significant light gas evolution occurs at the latter stages of tar evolution and during the residual char degassing phase, in the 650°C+ temperature range. In this respect the light gas evolution behavior is similar to middle to high rank coals. Despite its high fraction of functionality versus aromaticity, the light gas evolution of the polyimide is not similar to low rank, subbituminous or lignite, coals, which display significant light gas evolution during the main phase of tar evolution.

Temperature Dependency of Char Composition

The initiation of the carbon oxide evolution at temperatures lower than the main phase of methane evolution is reflected in the elemental composition of the polyimide char residue as indicated in Figures 11 - 14. From either an absolute (Figure 11) or relative basis (Figure 12) the oxygen composition of the char residue systematically decreases as a function of the decomposition temperature. On the other hand, the char hydrogen composition shows a slight enrichment (Figures 13, 14), relative to the parent structure, as the decomposition temperature is increased to 600°C. At greater peak temperatures, there is a rapid decrease in char hydrogen levels, corresponding to the steep temperature sensitivity of the methane evolution process.

The carbon composition of the polyimide chars displays a very slight increase with temperature to temperatures around 600°C. At greater peak temperatures, the carbon composition rapidly increases on either an absolute (Figure 15) or relative basis (Figure 16). The increase in carbon concentration between 300 and 600°C is due to the stoichiometric and mass ratios of oxygen to carbon in the evolved carbon oxides.

These behaviors are in sharp contrast to *all coal* samples wherein the char shows a systematic decrease in hydrogen composition during the initial mass loss, tar evolution phase. In this phase, the aliphatic rich heavy hydrocarbons are preferentially released. Carbon compositions of coal chars increase as decomposition temperatures are increased to 600°C, particularly for middle to high rank coals. Oxygen compositions of chars, relative to the parent coal, do not decrease significantly until peak temperatures of 700°C or greater are achieved, after the main phase of mass loss.

Nitrogen Evolution Behavior During Devolatilization

Figures 17 and 18 display the nitrogen evolution behavior of the polyimide on an absolute and relative basis, respectively. Figure 19 displays the temperature sensitivity of the IR-active, nitrogen containing light gas species. As indicated in Figures 17 and 18, and similar to the hydrogen, the nitrogen composition of the polyimide char is increased relative to the parent structure as the carbon oxides evolve and as methane begins to evolve. Between 550 and 600°C, NH_3 and HCN are observed to evolve (Figure 19).

On a sample-mass normalized and relative basis, the evolution of these species shows a sharp increase to peak decomposition temperatures between 700 and 750°C. Despite the continuous, sharp decrease in nitrogen levels observed in the residual char, at 750°C and greater there is a sharp decrease in the observed levels of these gases relative to the peak values observed near 700°C. It is not clear at this time if a different set of volatile nitrogen compounds are formed at these high decomposition temperatures or if there is a systematic error in the gas measurements. The latter seems unlikely. It appears the char nitrogen is preferentially evolved in low levels of various forms of benzonitriles (not detectable in the gas phase), N_2, or some combination of these species. These temperatures are associated with the formation of condensible tar from the polyimide (Figure 7) and these tars may be nitrogen rich relative to the parent structure. Because of its significance to high temperature evolution of fuel bound nitrogen during char combustion, this phenomenon should be more thoroughly investigated. It may be that the residual hydrogen content of the polyimide char at temperatures greater than 750°C may be too low for formation of NH_3 or HCN in the char substrate (Figures 13, 14).

Nitrogen Evolution Relative to the Reference Coal, PSOC 1451D

Figure 20 displays the mass fraction of the parent polyimide nitrogen retained in the char. As indicated, the parent polyimide nitrogen is retained in the char residue preferentially during the carbon oxide evolution, which is not associated with significant tar evolution. More significantly, this nitrogen retention behavior is significantly different than the nitrogen evolution from bituminous coals, wherein there is a systematic loss of fuel bound nitrogen during the main phase of devolatilization. The rapid, low temperature evolution of coal nitrogen is associated with the tar evolution process. Similar to the polyimide behavior, coals do not display any low temperature nitrogen-containing light gas evolution (4). Unlike polyimide, primary coal devolatilization does not evolve significant quantities of ammonia (4) at any temperature.

The significant differences in the nitrogen evolution behavior between an HVA bituminous coal and the polyimide during devolatilization is illustrated in Figures 21 and 22. During the main phase of mass evolution the HVA coal retains mass fraction parity between evolved mass and evolved bound nitrogen. Due to significant differences in the mode of mass loss, the polyimide never displays such parity.

It should be noted that all bituminous coals are observed to display this behavior (Figure 23, from ref. 4). Low rank coals evolve tars having significantly different structures than the average parent coal structure (2). These tars contain significant fractions of bound nitrogen, but not in mass fraction concentrations equal to the parent coal (Figure 23). Consequently, during the low temperature, main phase of mass evolution of low rank coals, significant fractions of fuel bound nitrogen are retained in the char, in a manner similar to the polyimide carbon oxide mass evolution phase. It is not known if the chars from low rank coals or high temperature chars from middle rank coals will display the same unusual nitrogen-containing light gas evolution behavior as the polyimide chars at large extents of hydrogen evolution.

Future Work

The reproducibility of the unusual nitrogen-containing light gas evolution of polyimide will be investigated. This is necessary because such chemical behavior may serve as a basis for understanding the evolution of char bound nitrogen and the observed low conversion efficiencies of char nitrogen to NO_x. As indicated above, char compositions of devolatilized and partially oxidized chars are similar to polyimides on a coalification band plot.

The global kinetics of nitrogen evolution from polyimide will be established and compared to the nitrogen evolution kinetics of coals during the main phases of respective sample mass losses.

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2. Freihaut, J.D., Proscia, W.M., and Seery, D.J., *Energy and Fuels*, 1989, 692.
3. Proscia, W.M., Freihaut, J.D., Mackie, J., *Volatility and Pyrolysis Characteristics of Primary Coal Tars Produced in an Entrained Flow Reactor*, submitted to Energy and Fuels, 1990. (Included in DE-AC22-89PC89759 Quarterly Report for Period 1 October 1989 - 1 January 1990.)
4. Freihaut, J.D., Proscia, W.M., et. al., *Combustion Properties of Micronized Coal for High Intensity Combustion Applications*, Final Report, U.S. DOE Contract DE-AC22-85PC80263, April, 1989.
5. Freihaut, J.D. and Proscia, W.M., Quarterly Report for Period: 1 January 1990 - 31 March 1990, Investigation of Rank Dependence of Tar Evolution, Contract DE-AC22-89PC89759.
6. Freihaut, J.D. and Proscia, W.M., Quarterly Report for Period: 1 April 1990 - 30 June 1990, Investigation of Rank Dependence of Tar Evolution, Contract DE-AC22-89PC89759.
7. Frazer, A.H., "Aromatic Polymers Containing Heterocyclic Rings," in *High Temperature Resistant Polymers*, Interscience, John Wiley & Sons, N.Y. (1968).

FIGURE 1
COALIFICATION BAND PLOT OF SAMPLES:
63-75 MICRON PARTICLES OF "D" COALS

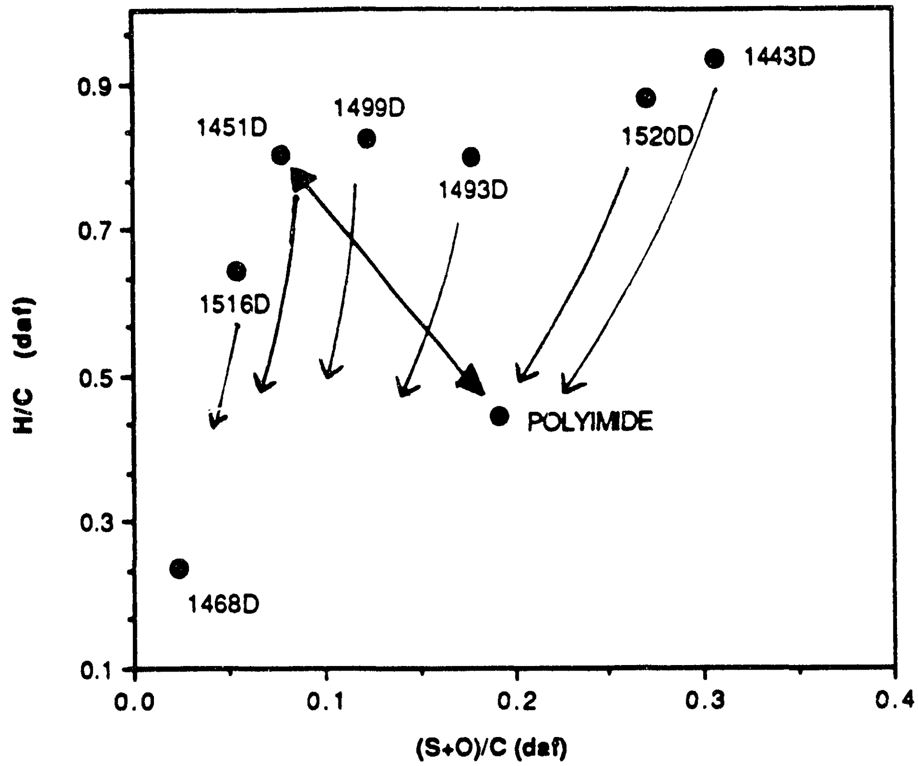


FIGURE 2
(S+O)/H VS. (S+O)/C

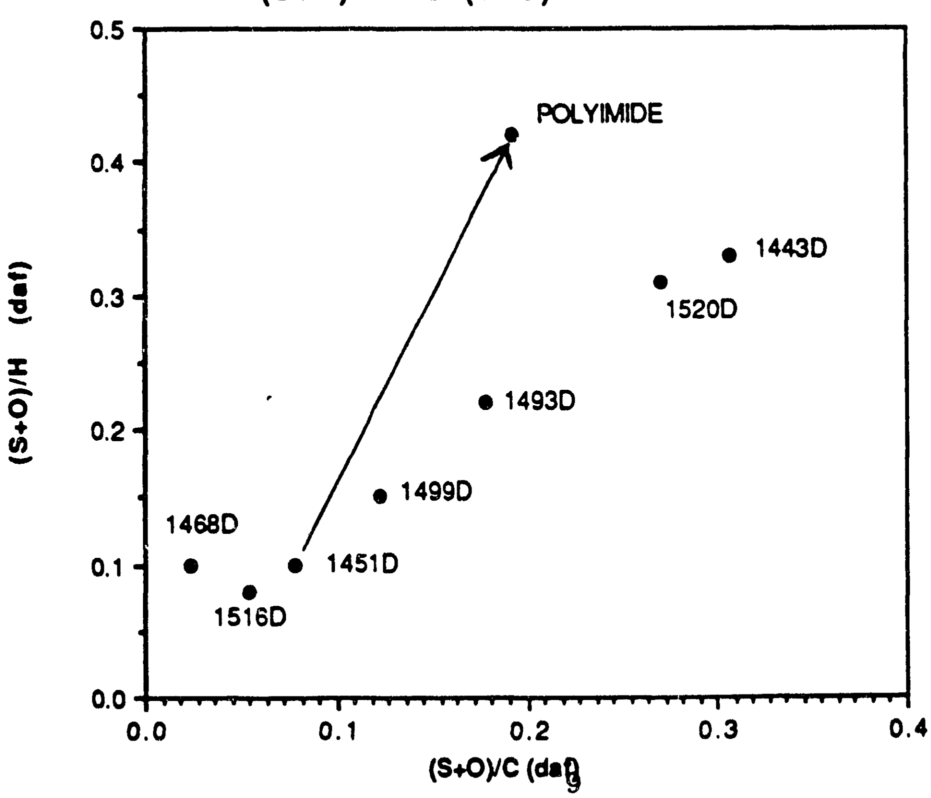
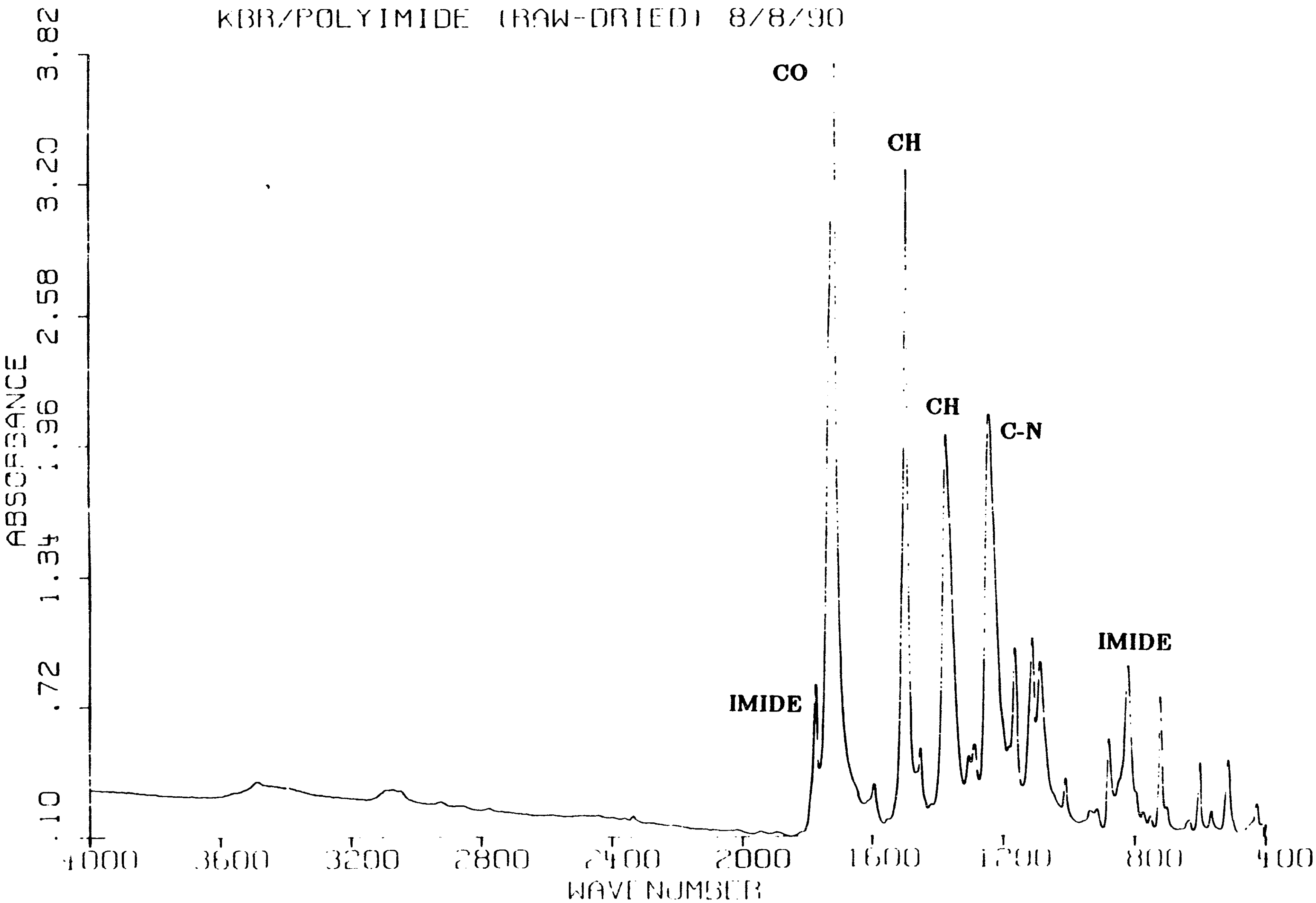


FIGURE 3



KBR/POLYIMIDE (RAW-DRIED) 8/8/90
CO
CH
CH
C-N
IMIDE
IMIDE
ABSORBANCE
3.82
3.20
2.58
1.96
1.34
.72
.10
4000
3600
3200
2800
2400
2000
1600
1200
800
400
WAVENUMBER

FIGURE 4

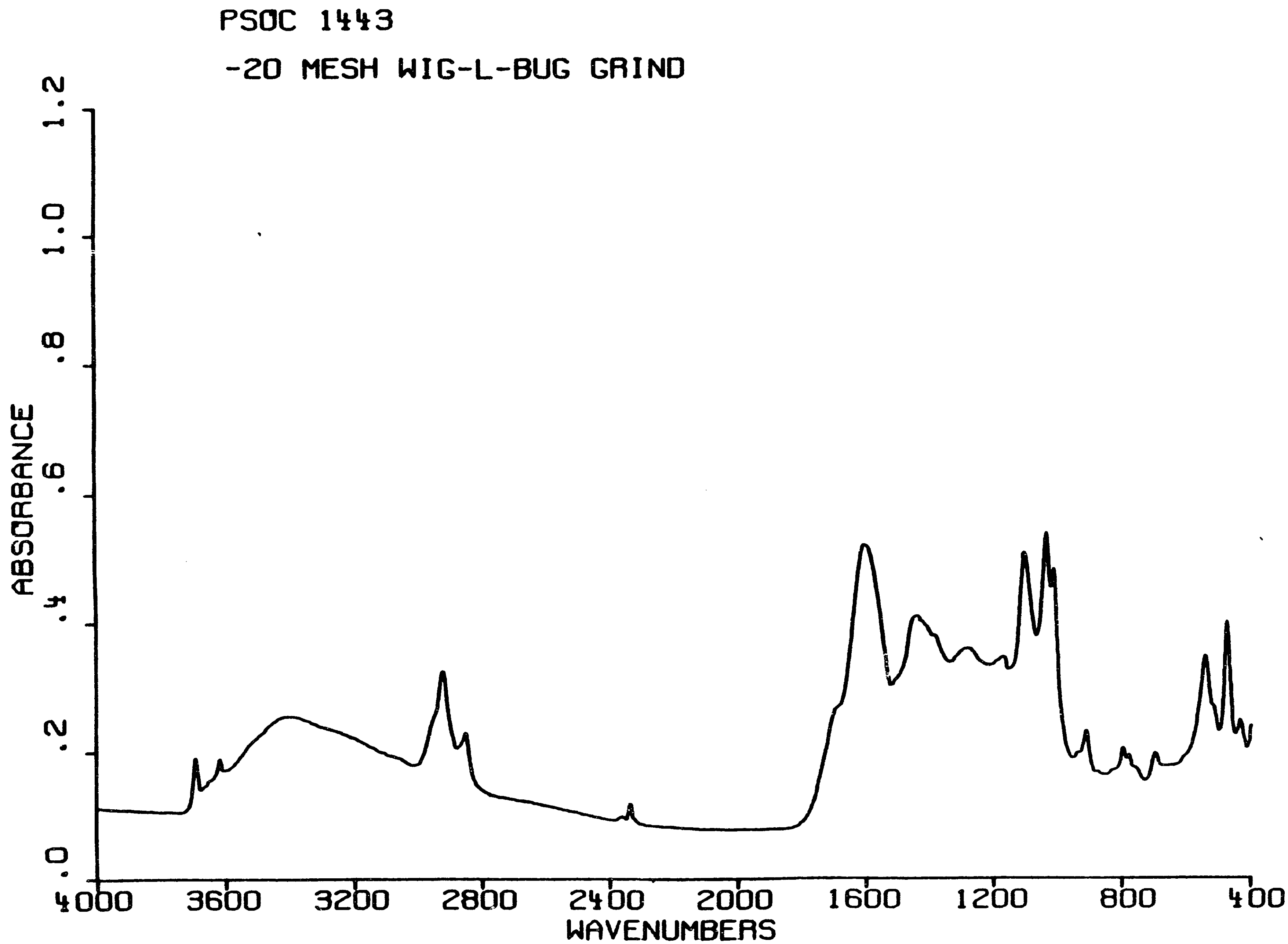

PSOC 1443
-20 MESH WIG-L-BUG GRIND
ABSORBANCE
0.
.2
.4
.6
.8
1.0
1.2
4000
3600
3200
2800
2400
2000
1600
1200
800
400
WAVENUMBERS

FIGURE 5

PSOC 1493

-20 MESH WIG-L-BUG GRIND

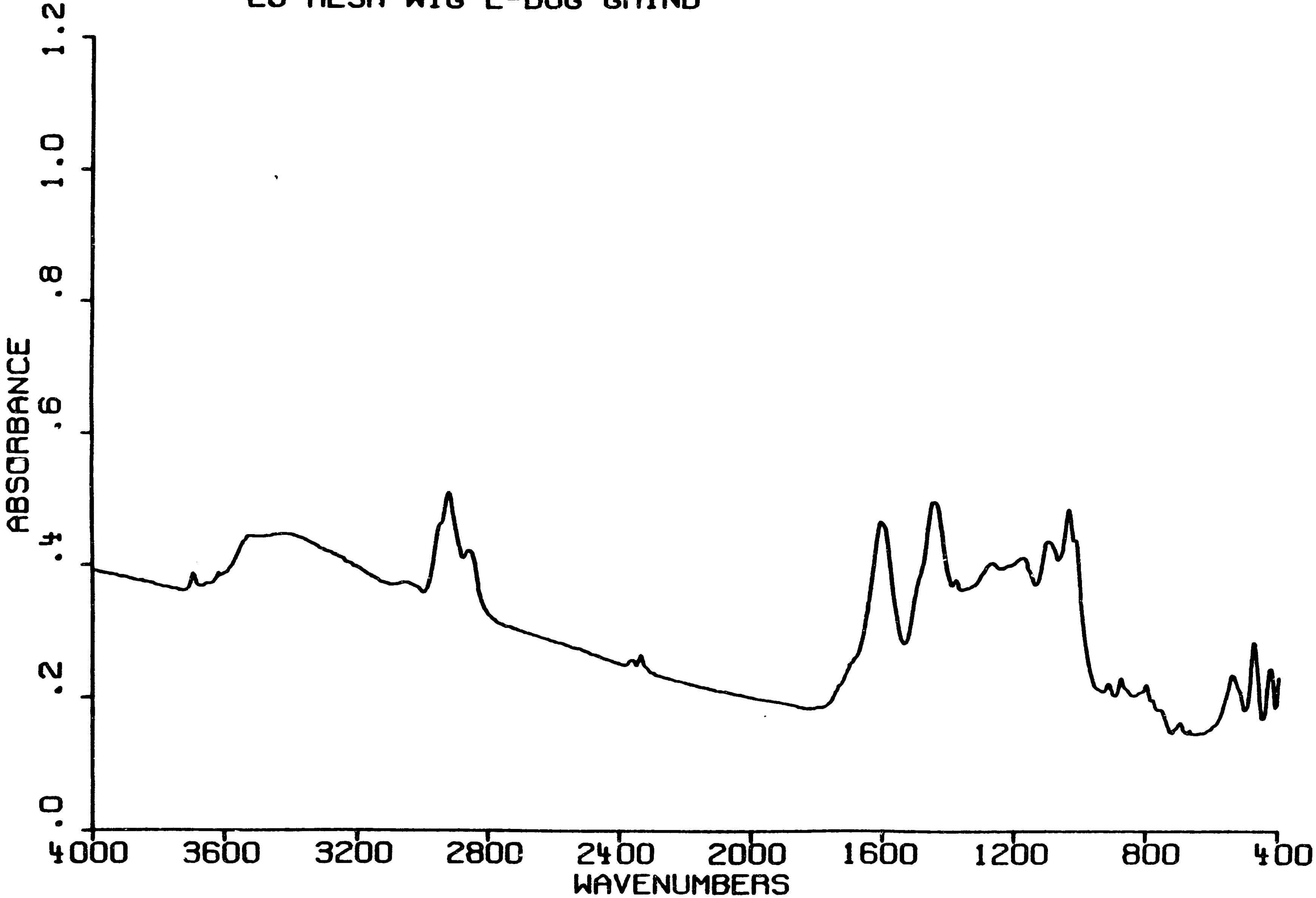


FIGURE 6

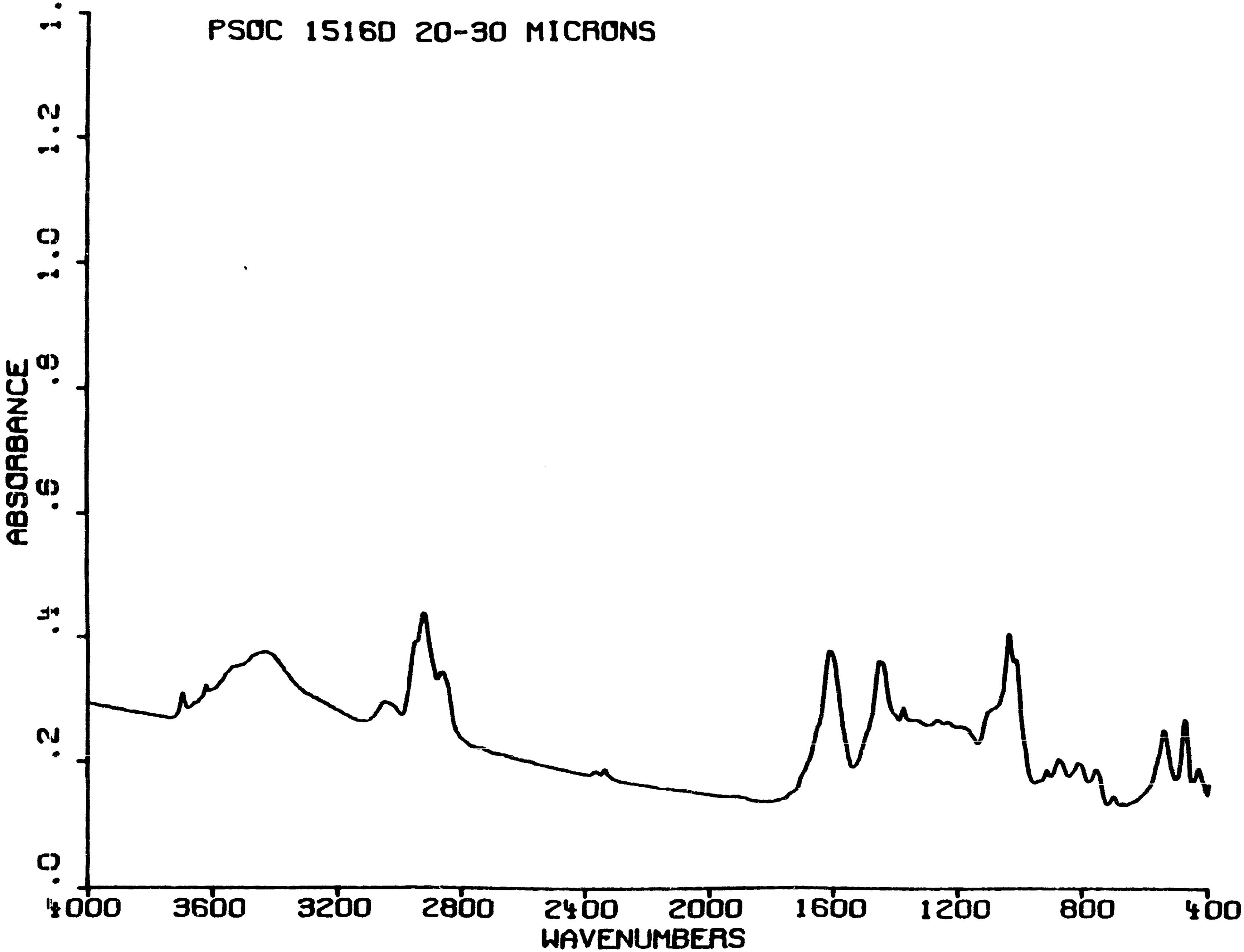

PSOC 1516D 20-30 MICRONS
ABSORBANCE
.0
.2
.4
.6
.8
1.0
1.2
1.4
4000
3600
3200
2800
2400
2000
1600
1200
800
400
WAVENUMBERS

FIGURE 7
MAJOR PRODUCTS: POLYIMIDE DECOMPOSTION
LHT DATA

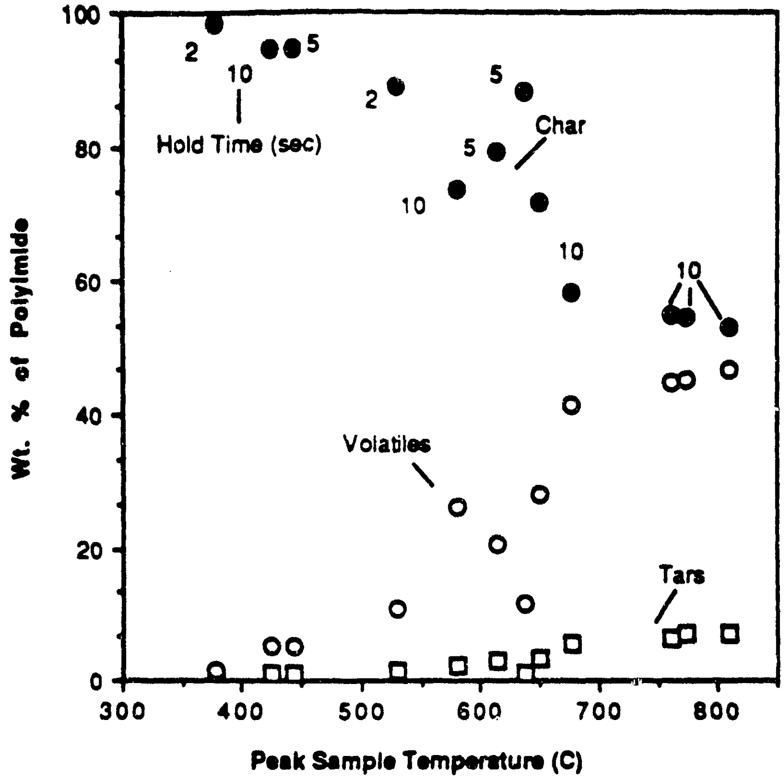
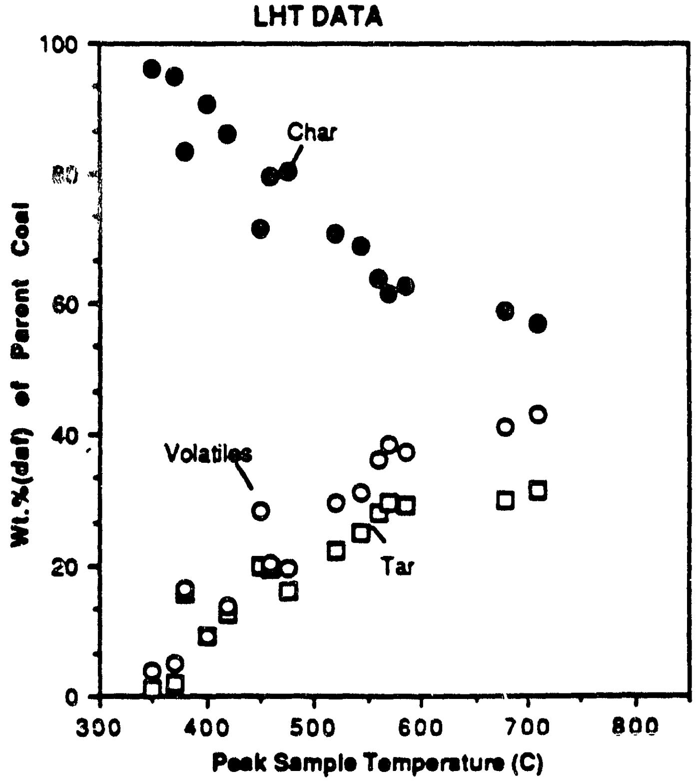


FIGURE 8
MAJOR PRODUCTS: 1451DECOMPOSTION
LHT DATA



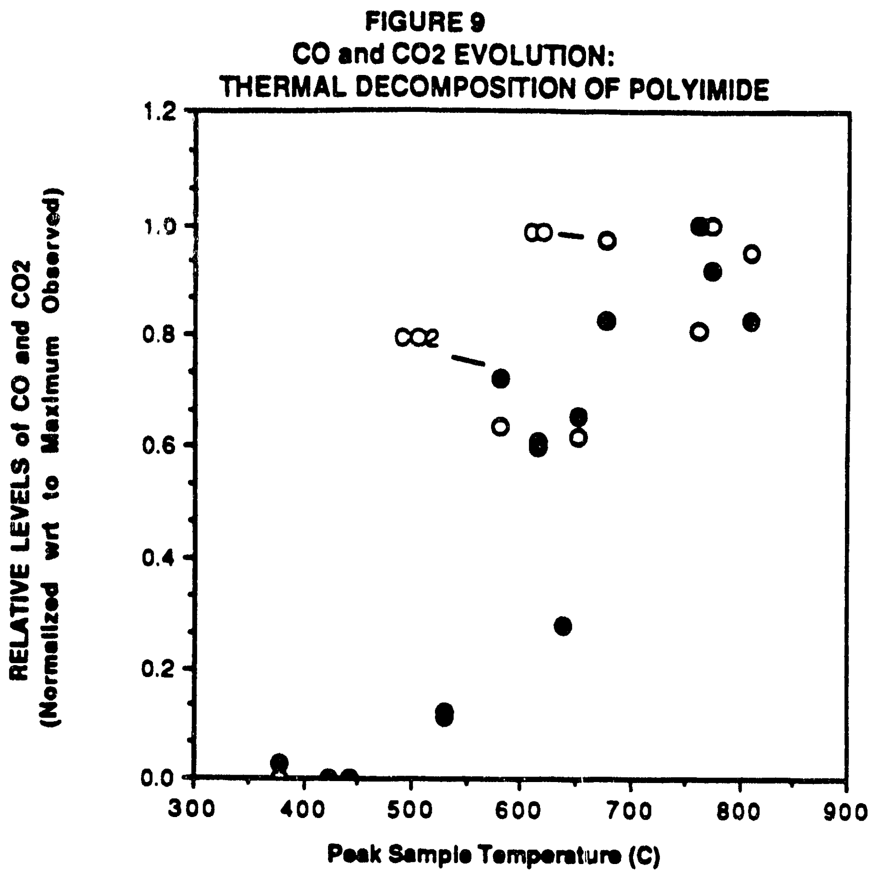


FIGURE 9
CO and CO2 EVOLUTION:
THERMAL DECOMPOSITION OF POLYIMIDE
RELATIVE LEVELS of CO and CO2
(Normalized wrt to Maximum Observed)
CO
CO2
1.2
1.0
0.8
0.6
0.4
0.2
0.0
300
400
500
600
700
800
900
Peak Sample Temperature (C)

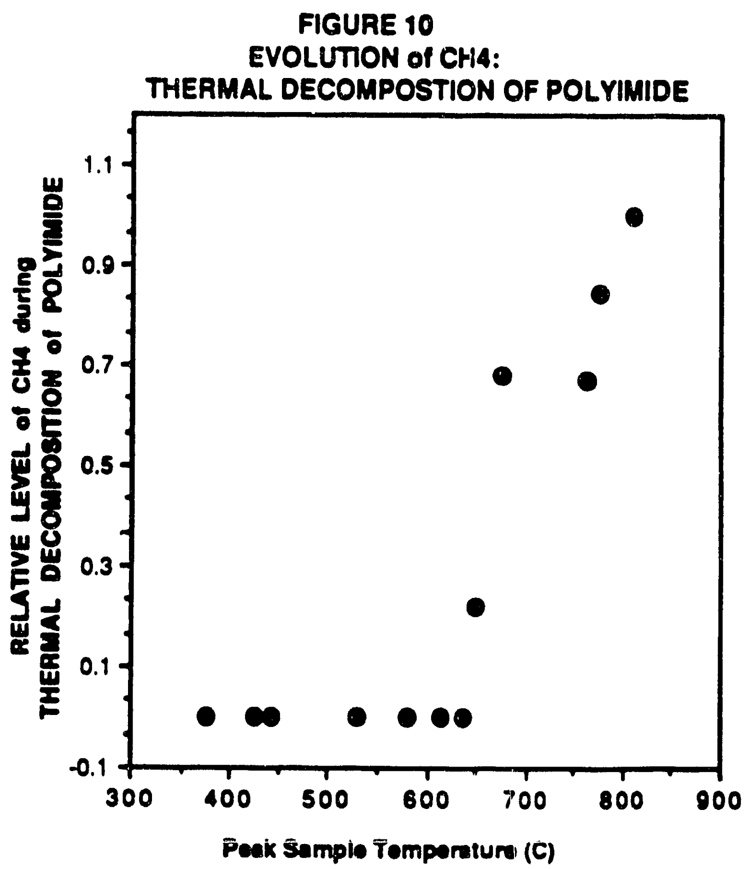


FIGURE 10
EVOLUTION of CH4:
THERMAL DECOMPOSTION OF POLYIMIDE
RELATIVE LEVEL of CH4 during
THERMAL DECOMPOSITION of POLYIMIDE
1.1
0.9
0.7
0.5
0.3
0.1
-0.1
300
400
500
600
700
800
900
Peak Sample Temperature (C)

FIGURE 11
Changes in Oxygen Composition with
Peak Temperature of Decomposition

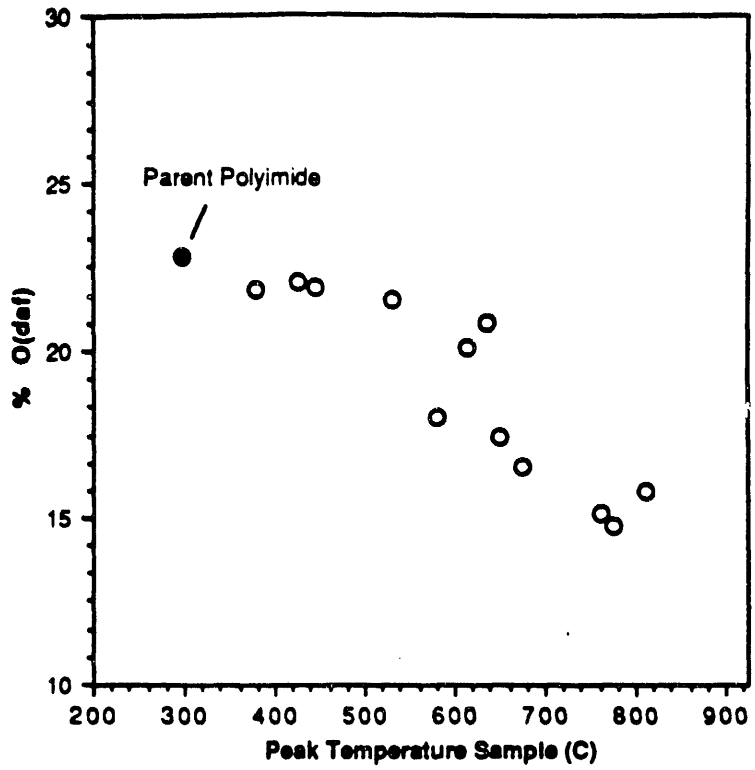


FIGURE 12
O-char/O-parent with
PEAK DECOMPOSITION TEMPERATURE

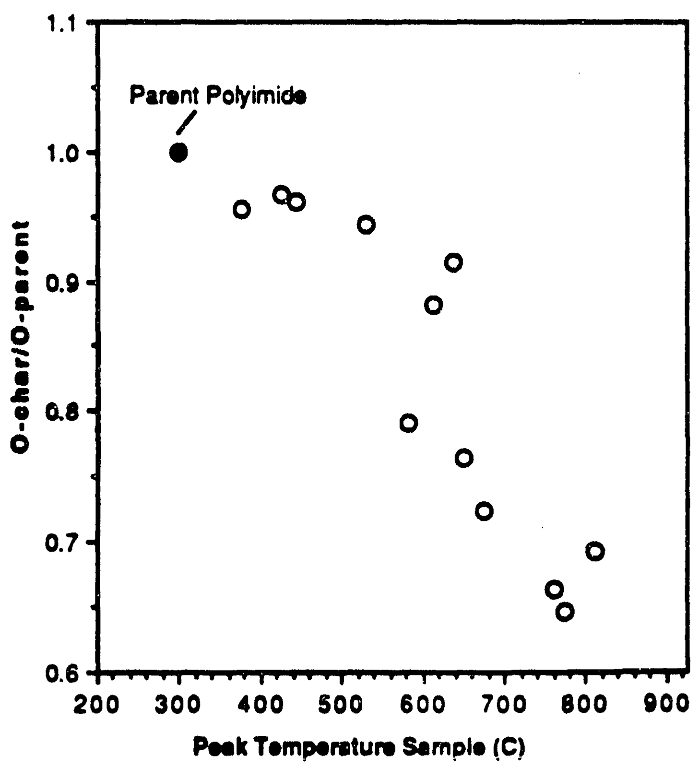


FIGURE 13
Changes in Hydrogen Composition with
Peak Temperature of Decomposition:

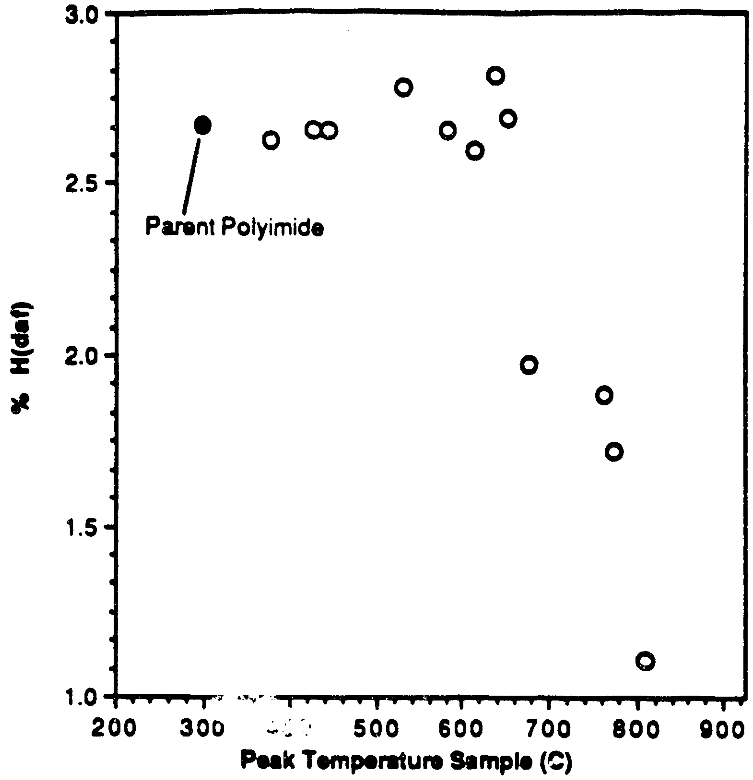


FIGURE 14
H-char/H-parent with
PEAK DECOMPOSITION TEMPERATURE

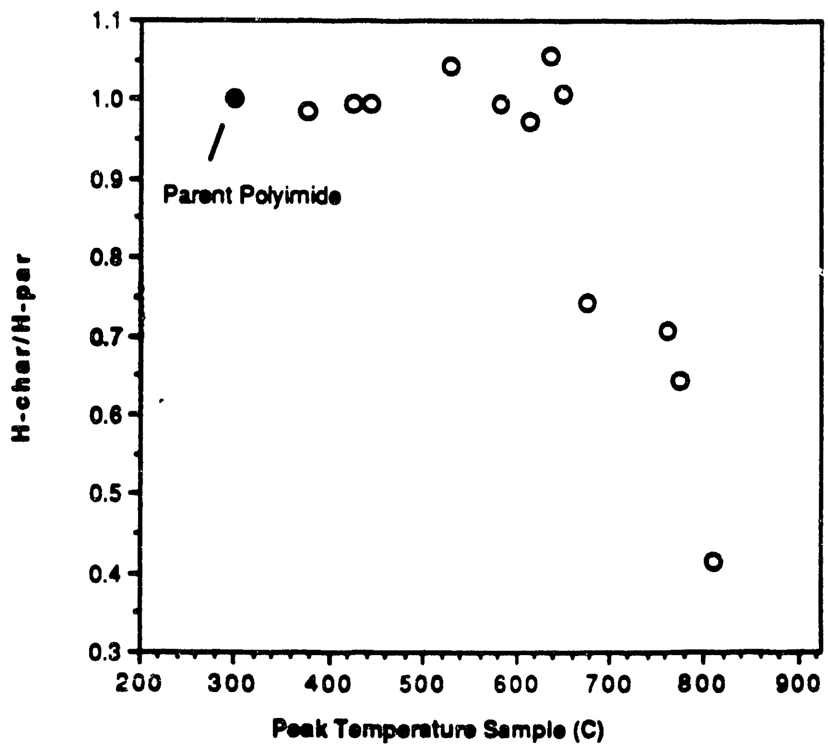


FIGURE 15
Changes in Carbon Composition with
Peak Temperature of Decomposition:

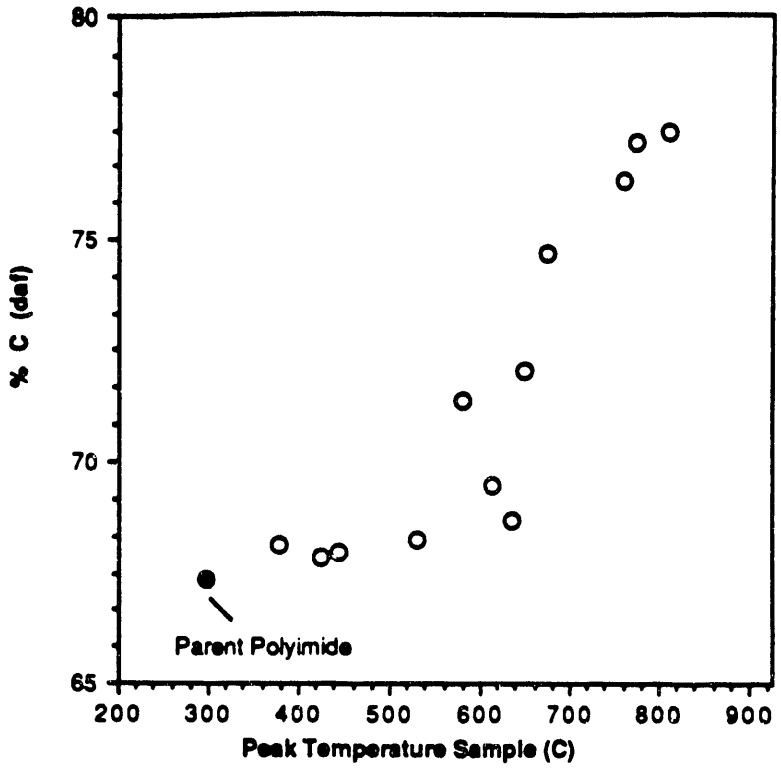


FIGURE 16
C-char/C-parent with
PEAK DECOMPOSITION TEMPERATURE

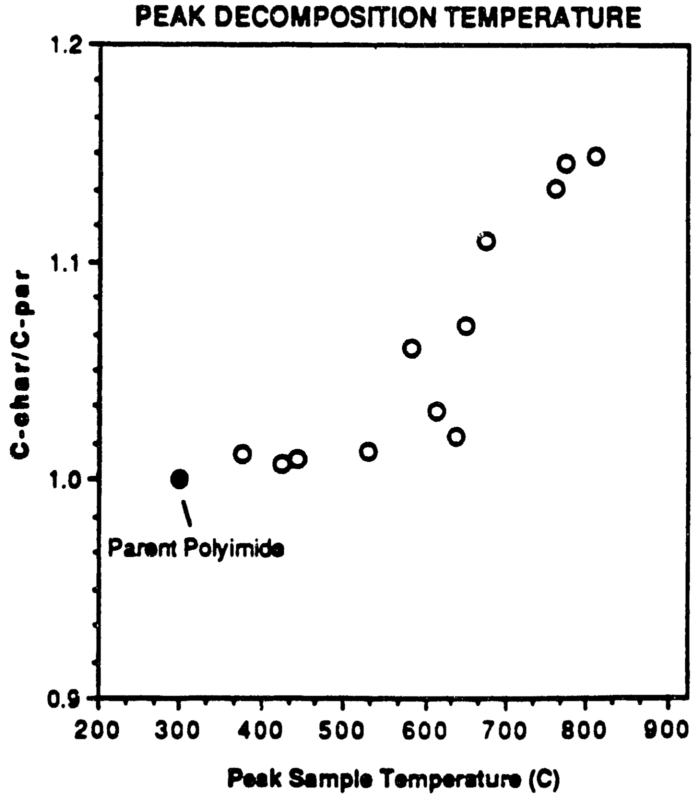


FIGURE 17
Changes In Nitrogen Composition with
Peak Temperature of Decomposition

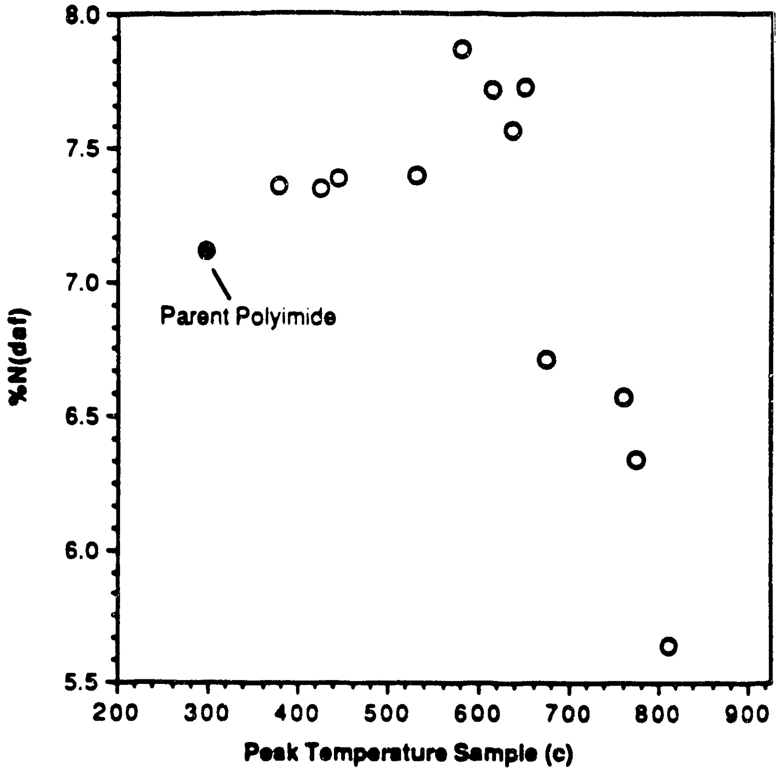


FIGURE 18
N-char/N-parent with
PEAK DECOMPOSITION TEMPERATURE

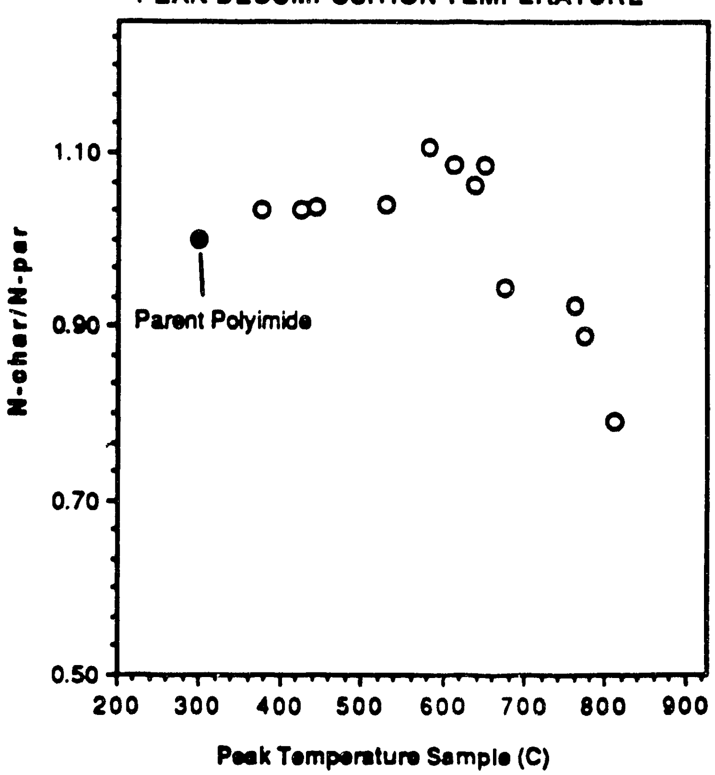


FIGURE 19
EVOLUTION of HCN and NH3:
DECOMPOSITION OF POLYIMIDE

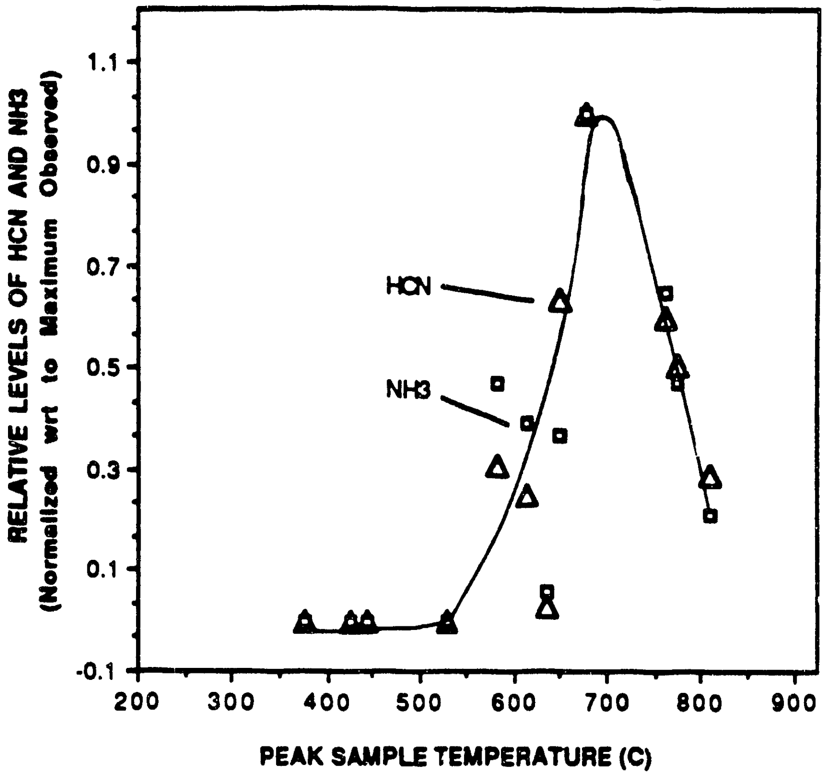


FIGURE 20
Mass Fraction of Parent Sample Remaining
Char Residues :Polyimide, PSOC 1451d

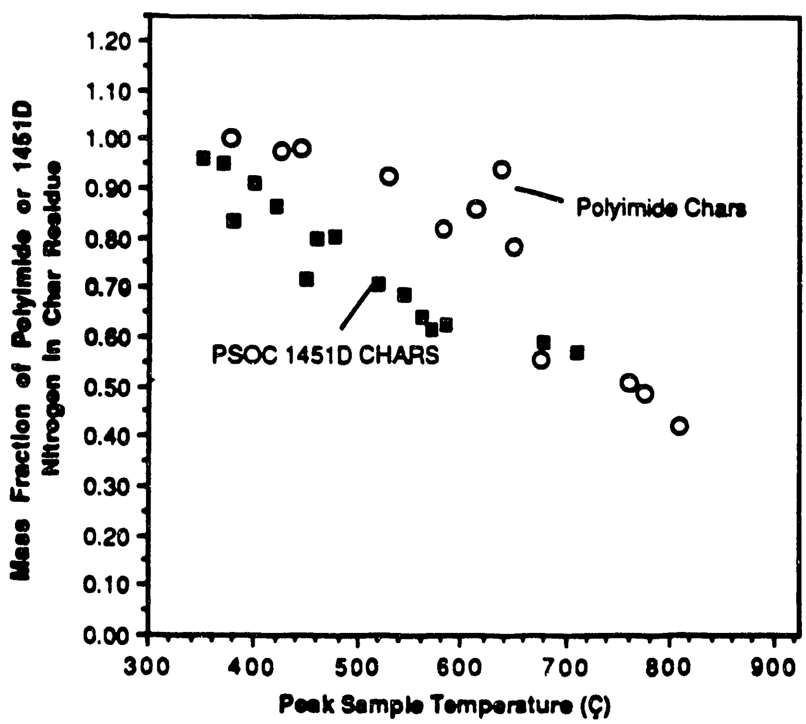


FIGURE 21
Mass Fraction Relationships
Polyimide and HVA Bituminous Coal

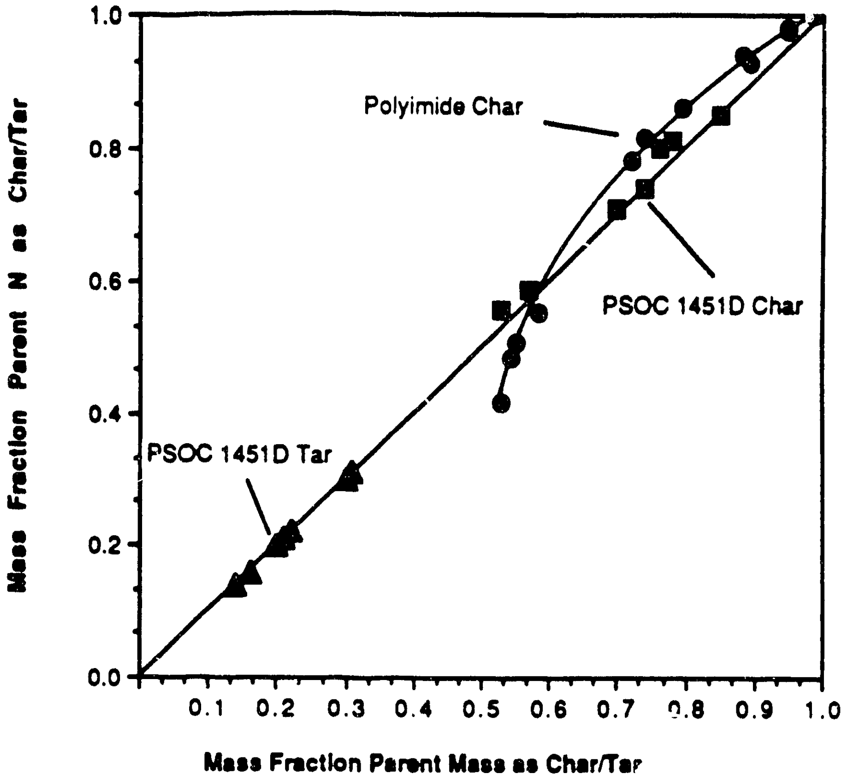


FIGURE 22
Comparison of Evolution Behavior
of Nitrogen-Containing Light Gas Evolution

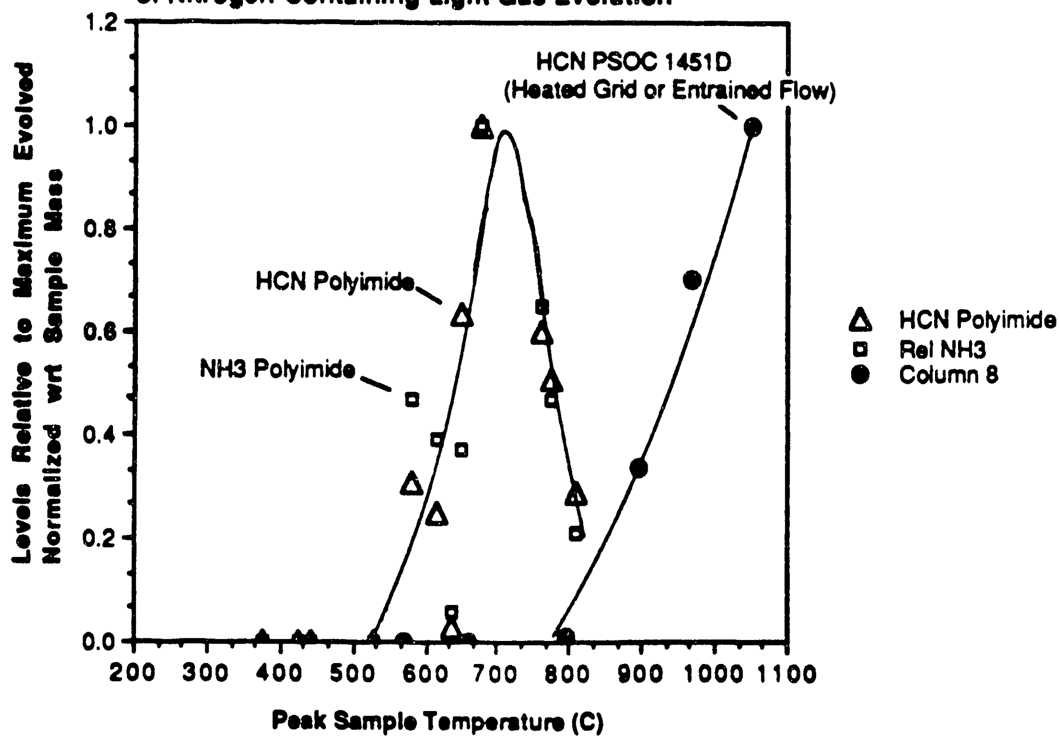
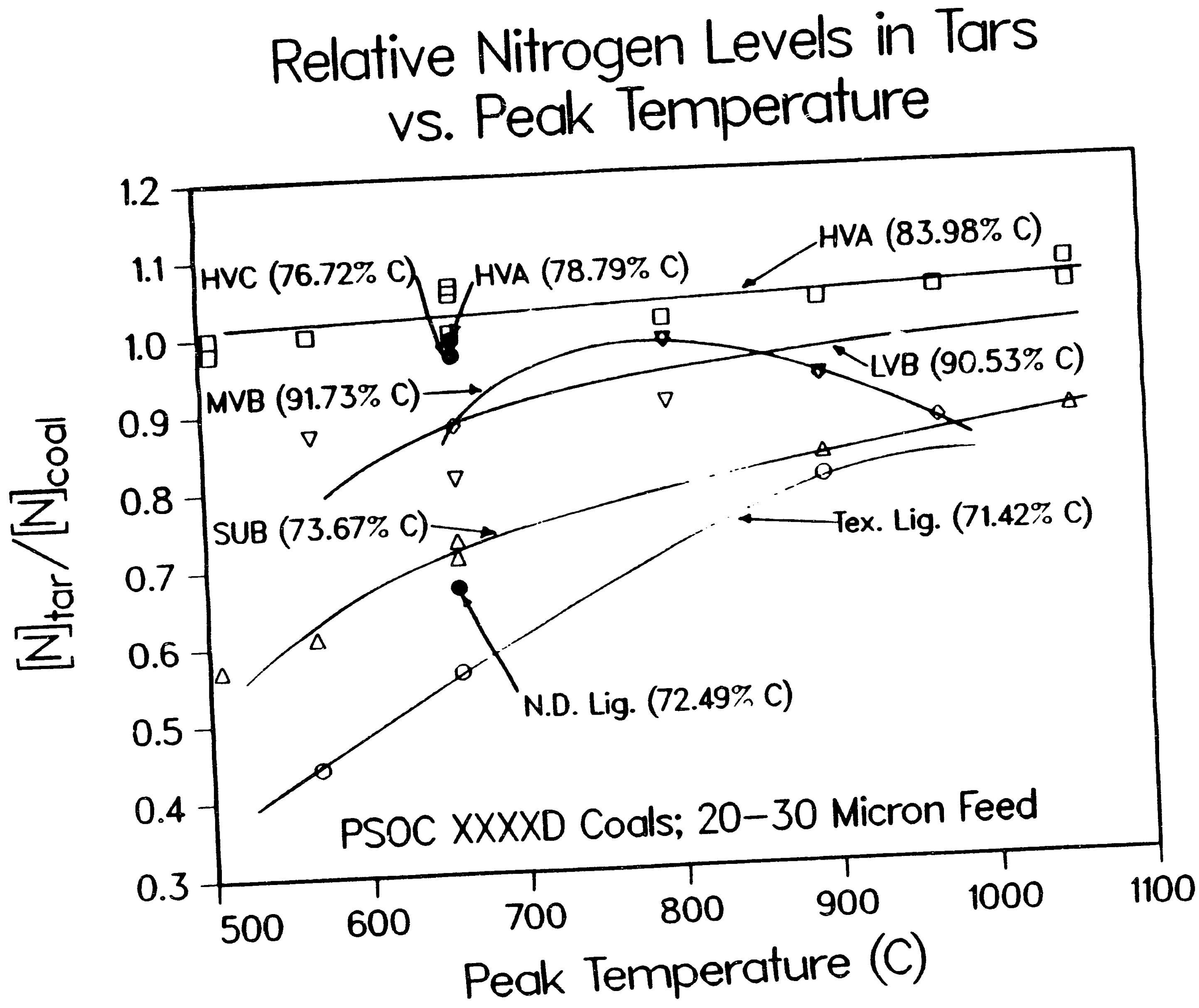


FIGURE 23



Relative Nitrogen Levels in Tars vs. Peak Temperature
HVC (76.72% C)
HVA (78.79% C)
HVA (83.98% C)
LVB (90.53% C)
MVB (91.73% C)
SUB (73.67% C)
Tex. Lig. (71.42% C)
N.D. Lig. (72.49% C)
PSOC XXXXD Coals; 20–30 Micron Feed
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
500
600
700
800
900
1000
1100
Peak Temperature (C)
[N]tar/[N]coal

TABLE I - RANK EFFECTS: COAL STRUCTURAL CHARACTERISTICS

Coal I.D.	AVE. D, mic.	(%C)ME	(%H)ME	(%N)ME	(PE-%ASH)ME	(%S+O)ME	%(ASTM ASH)ME	AS RCD H2O%		M%	%ASTM(ASH)MF	(%C)MF	(%H)MF
PSOC 1443D	69	52.37	4.06	1	16.4	26.17	19.3	7.2		4.9	20.31	55.10	4.27
	69	52.19	4.04	1.04	16.3	26.43	19.5	7.1		5	20.52	54.91	4.25
	69	52.2	4	1	16.3	26.5	19.2	7.1			20.20	54.92	4.21
	69	52.36	4.13	1	16.5	26.01						55.09	4.35
	AVE:	52.28	4.06	1.01	16.38	26.28	19.33	7.13		4.95	20.34	55.00	4.27
PSOC 1520D	69	59.4	4.3	0.83	9.7	27.77	11.9	13.9		4.2	12.42	61.97	4.49
	69	56.46	4.35	0.86	9.7	25.63	11.9	13.9		4.1	12.42	62.03	4.54
	69	59.42	4.34	0.84	9.7	25.7	12	13.7			12.52	61.99	4.53
	69	59.6	4.37	0.83	9.6	25.6						62.18	4.56
	AVE:	59.47	4.34	0.84	9.68	26.18	11.93	13.83		4.15	12.45	62.04	4.53
PSOC 1499D	69	74.97	5.14	1.47	4.4	14.02	4.8	3		1.7	4.88	76.27	5.23
	69	75.02	5.19	1.47	4.5	13.82	4.8	2.9		1.7	4.88	76.32	5.28
	69	74.89	5.15	1.47	4.7	13.79	4.8	3			4.88	76.19	5.24
	69	74.84	5.11	1.47	4.5	14.06						76.13	5.20
	AVE:	74.93	5.15	1.47	4.53	13.92	4.80	2.97		1.7	4.89	76.23	5.24
PSOC 1493D	69	64.39	4.28	1.24	12.8	17.31	13	1.63		2.1	13.27	65.74	4.35
	69	64.37	4.29	1.24	12.8	17.3	13.1	1.63		2	13.37	65.72	4.38
	69	64.45	4.29	1.26	12.5	17.5	13.1	1.65			13.37	65.80	4.38
	69	64.38	4.27	1.24	12.6	17.51						65.73	4.36
	AVE:	64.40	4.28	1.25	12.68	17.41	13.07			2.05	13.34	65.75	4.37
PSOC 1451D	69	79.06	5.30	1.54	4.19	9.91	3.30	NA		1.6	3.35	80.35	5.39
	69	79.28	5.30	1.53	4.09	9.80	3.30	NA		1.6	3.35	80.57	5.39
	69	79.31	5.30	1.47	4.19	9.73	3.30	NA		1.6	3.35	80.60	5.39
	69	79.03	5.30	1.56	3.90	10.21	3.30	NA		1.6	3.35	80.32	5.39
	69	79.17	5.30	1.52	4.09	9.92	3.30	NA		1.6	3.35	80.46	5.39
	AVE:	79.17	5.30	1.53	4.09	9.91	3.30	NA		1.60	3.35	80.46	5.39
PSOC 1451D	69	79.97	5.37	1.57	3.50	9.59	3.30	NA		1.6	3.35	81.27	5.46
ORIGINAL	69	79.87	5.37	1.56	3.60	9.60	3.30	NA		1.6	3.35	81.17	5.46
BOTTLE	69	79.56	5.36	1.54	3.70	9.84	3.30	NA		1.6	3.35	80.85	5.45
	AVE:	79.80	5.37	1.56	3.60	9.68	3.30	NA		1.60	3.35	81.10	5.45
PSOC 1451D	69	79.03	5.19	1.56	4.20	10.02	3.30	NA		1.6	3.35	80.32	5.27
OXIDIZED	69	79.19	5.25	1.56	3.40	10.60	3.30	NA		1.6	3.35	80.48	5.34
BOTTLE	69	79.01	5.25	1.56	4.20	9.98	3.30	NA		1.6	3.35	80.29	5.34
	AVE:	79.08	5.23	1.56	3.93	10.20	3.30	NA		1.60	3.35	80.36	5.32
PSOC 1516D	69	72.56	3.89	1.28	16.9	5.37	16.9	0.19		0.21	16.94	72.71	3.90
	69	72.4	3.9	1.32	16.7	5.68	16.9	0.16		0.21	16.94	72.55	3.91
	69	72.38	3.87	1.29	16.8	5.66	17	0.22			17.04	72.53	3.88
	69	72.78	3.89	1.26	16.8	5.27						72.93	3.90
	AVE:	72.53	3.89	1.29	16.80	5.50	16.93			0.21	16.97	72.68	3.90
PSOC1468D	69	87.39	1.73	0.68	6.5	3.7	6.6	3.2		1.1	6.67	88.32	1.76
	69	87.03	1.71	0.69	6.4	4.17	6.4	6.6		1	6.47	87.95	1.71
	69	87.33	1.74	0.68	6.4	3.85	6.6	3.2			6.67	88.26	1.74
	69	87.4	1.74	0.7	6.4	3.76						88.33	1.74
	AVE:	87.29	1.73	0.69	6.43	3.87	6.53			1.05	6.60	88.21	1.73
POLYIMIDE		67.46	2.63	7.12	0	22.79	0	0		0	0.00	67.46	2.63
		67.1	2.66	7.12	0	23.12	0	0		0	0.00	67.10	2.66

TABLE I (cont.) - RANK EFFECTS: COAL STRUCTURAL CHARACTERISTICS

Coal I.D.	AVE. D, mic.	(%C)ME	(%H)…	[illegible]	(PE-%ASH)ME	(%S+O)ME	%(ASTM ASH)ME	AS-RCD H2O%		MB%	%ASTM(ASH)MF	(%C)MF	(%H)MF
		67.57	2.72	[illegible]	0	22.63	0	0		0	0.00	77.22	2.72
		67.45	2.71	7.2	0	22.64	0	0		0	0.00	77.17	2.71
		67.23	2.67	7.11	0	22.99	0	0		0	0.00	76.83	2.67
		67.31	2.64	7.07	0	22.98	0	0		0	0.00	67.31	2.64
	AVE:	67.35	2.67	7.12	0.00	22.86	0.00	0.00		0.00	0.00	72.18	2.67

TABLE I (cont.) - RANK EFFECTS: COAL STRUCTURAL CHARACTERISTICS

Coal I.D.	(%N)MF	%(PE-ASH)MF	(%S+O)MF	(%C)DAF	(%H) DAF	(%N)DAF	(%S+O) DAF	MOLES C	MOLES H	MOLES N	MOLES (S+O)	Hx	Oy	Nz
PSOC 1443D	1.05	17.25	22.33	66.58	5.16	1.27	27.00	5.55	5.16	0.0908	1.69	9.30E-01	3.04E-01	1.64E-02
	1.09	17.15	22.60	66.34	5.14	1.32	27.21	5.53	5.14	0.0944	1.70	9.29E-01	3.08E-01	1.71E-02
	1.05	17.15	22.67	66.35	5.08	1.27	27.30	5.53	5.08	0.0908	1.71	9.20E-01	3.09E-01	1.64E-02
	1.05	17.36	22.16	66.55	5.25	1.27	26.93	5.55	5.25	0.0908	1.68	9.47E-01	3.03E-01	1.64E-02
	1.06	17.23	22.44	66.45	5.16	1.28	27.11	5.54	5.16	0.0917	1.69	9.31E-01	3.06E-01	1.66E-02
PSOC 1520D	0.87	10.12	22.56	68.95	4.99	0.96	25.10	5.75	4.99	0.0686	1.57	8.69E-01	2.73E-01	1.20E-02
	0.90	10.12	22.41	69.02	5.05	1.00	24.93	5.75	5.05	0.0713	1.56	8.78E-01	2.71E-01	1.24E-02
	0.88	10.12	22.48	68.97	5.04	0.98	25.01	5.75	5.04	0.0696	1.56	8.76E-01	2.72E-01	1.21E-02
	0.87	10.02	22.38	69.18	5.07	0.96	24.78	5.77	5.07	0.0688	1.55	8.80E-01	2.69E-01	1.19E-02
	0.88	10.09	22.46	69.03	5.04	0.98	24.96	5.75	5.04	0.0696	1.56	8.76E-01	2.71E-01	1.21E-02
PSOC 1499D	1.50	4.48	12.63	79.95	5.48	1.57	13.00	6.66	5.48	0.1120	0.81	8.23E-01	1.22E-01	1.68E-02
	1.50	4.58	12.33	80.00	5.53	1.57	12.90	6.67	5.53	0.1120	0.81	8.30E-01	1.21E-01	1.68E-02
	1.50	4.78	12.30	79.86	5.49	1.57	13.08	6.66	5.49	0.1120	0.82	8.25E-01	1.23E-01	1.68E-02
	1.50	4.58	12.59	79.81	5.45	1.57	13.18	6.65	5.45	0.1120	0.82	8.19E-01	[illegible]	1.68E-02
	1.50	4.60	12.44	79.90	5.49	1.57	13.04	6.66	5.49	0.1120	0.81	8.24E-01	1.22E-01	1.68E-02
PSOC 1493D	1.27	13.07	15.58	75.51	5.00	1.45	18.04	6.29	5.00	0.1039	1.13	7.94E-01	1.79E-01	1.65E-02
	1.27	13.07	15.67	75.49	5.03	1.45	18.03	6.29	5.03	0.1039	1.13	8.00E-01	1.79E-01	1.65E-02
	1.29	12.76	15.77	75.58	5.03	1.48	17.91	6.30	5.03	0.1055	1.12	7.99E-01	1.78E-01	1.68E-02
	1.27	12.86	15.78	75.50	5.01	1.45	18.04	6.29	5.01	0.1039	1.13	7.96E-01	1.79E-01	1.65E-02
	1.27	12.94	15.68	75.52	5.02	1.46	18.01	6.29	5.02	0.1043	1.13	7.97E-01	1.79E-01	1.66E-02
PSOC 1451D	1.57	4.28	8.45	83.83	5.62	1.83	8.91	6.99	5.62	0.1166	0.56	8.04E-01	7.98E 02	1 67E-02
	1.55	4.16	8.33	84.07	5.62	1.82	8.69	7.01	5.62	0.1159	0.54	8.02E-01	7.75E-02	1.65E-02
	1.49	4.28	8.28	84.10	5.62	1.56	8.72	7.01	5.62	0.1113	0.55	8.02E-01	7.78E-02	1.59E-02
	1.59	3.96	8.75	83.80	5.62	1.65	8.93	6.98	5.62	0.1182	0.56	8.05E-01	7.99E-02	1.69E-02
	1.54	4.16	8.46	83.95	5.62	1.61	8.82	7.00	5.62	0.1151	0.55	8.03E-01	7.88E-02	1.65E-02
	1.55	4.16	8.45	83.95	5.62	1.62	8.81	7.00	5.62	0.12	0.55	8.03E-01	7.87E-02	1.65E-02
PSOC 1451D ORIGINAL BOTTLE	1.60	3.56	8.12	84.36	5.66	1.66	8.32	7.03	5.66	0.1183	0.52	8.06E-01	7.40E-02	1.69E-02
	1.59	3.66	8.13	84.25	5.66	1.65	8.44	7.02	5.66	0.1175	0.53	8.07E-01	7.51E-02	1.67E-02
	1.57	3.76	8.37	83.92	5.65	1.62	8.80	6.99	5.65	0.1160	0.55	8.08E-01	7.86E-02	1.66E-02
	1.58	3.66	8.21	84.18	5.66	1.64	8.52	7.01	5.66	0.12	0.53	8.07E-01	7.59E-02	1.67E-02
PSOC 1451D OXIDIZED BOTTLE	1.59	4.27	8.56	83.66	5.49	1.65	9.20	6.97	5.49	0.1180	0.57	7.88E-01	8.24E-02	1.69E-02
	1.59	3.46	9.15	83.83	5.56	1.65	8.96	6.99	5.56	0.1180	0.56	7.96E-01	8.02E-02	1.69E-02
	1.59	4.27	8.52	83.64	5.56	1.65	9.15	6.97	5.56	0.1180	0.57	7.97E-01	8.21E-02	1.69E-02
	1.59	4.00	8.74	83.71	5.54	1.65	9.10	6.98	5.54	0.12	0.57	7.94E-01	8.16E-02	1.69E-02
PSOC 1516D	1.28	16.94	5.17	87.43	4.69	1.54	6.34	7.29	4.69	0.1102	0.40	6.43E-01	5.44E-02	1.51E-02
	1.32	16.74	5.48	87.24	4.71	1.59	6.46	7.27	4.71	0.1138	0.40	6.47E-01	5.55E-02	1.57E-02
	1.29	16.84	5.46	87.22	4.67	1.56	6.56	7.27	4.67	0.1112	0.41	6.43E-01	5.64E-02	1.53E-02
	1.26	16.84	5.07	87.70	4.69	1.52	6.09	7.31	4.69	0.1086	0.38	6.42E-01	5.21E-02	1.49E-02
	1.29	16.84	5.30	87.40	4.69	1.55	6.36	7.28	4.69	0.1109	0.40	6.44E-01	5.46E-02	1.52E-02
PSOC 1468D	0.69	6.57	2.88	94.46	1.87	0.73	2.95	7.87	1.87	0.0526	0.18	2.38E-01	2.34E-02	6.67E-03
	0.70	6.47	3.17	94.06	1.83	0.75	3.36	7.84	1.83	0.0533	0.21	2.33E-01	2.68E-02	6.80E-03
	0.69	6.47	2.86	94.39	1.86	0.73	3.02	7.87	1.86	0.0526	0.19	2.37E-01	2.40E-02	6.67E-03
	0.71	6.47	2.76	94.46	1.86	0.76	2.92	7.87	1.86	0.0540	0.18	2.36E-01	2.32E-02	6.86E-03
	0.69	6.49	2.86	94.34	1.86	0.74	3.06	7.86	1.86	0.0531	0.19	2.36E-01	2.43E-02	6.75E-03
POLYIMIDE	7.12	0	22.79	67.46	2.63	7.12	22.79	5.62	2.63	0.5086	1.42	4.68E-01	2.63E-01	9.06E-02
	7.12	0	23.12	67.10	2.66	7.12	23.12	5.59	2.66	0.5086	1.45	4.76E-01	2.68E-01	9.[illegible]0E-02

TABLE I (cont.) - RANK EFFECTS: COAL STRUCTURAL CHARACTERISTICS

Coal I.D.	(%N)MF	%(PE-ASH)MF	(%S+O)MF	(%C)DAF	(%H) DAF	(%N)DAF	(%S+O) DAF	MOLES C	MOLES H	MOLES N	MOLES (S+O)	H_x	O_y	N_z
	7.08	0	12.98	77.22	2.72	7.08	12.98	6.44	2.72	0.5057	0.81	4.23E-01	1.26E-01	7.86E-02
	7.2	0	12.92	77.17	2.71	7.20	12.92	6.43	2.71	0.5143	0.81	4.21E-01	1.26E-01	8.00E-02
	7.11	0	13.39	76.83	2.67	7.11	13.39	6.40	2.67	0.5079	0.84	4.17E-01	1.31E-01	7.93E-02
	7.07	0	22.98	67.31	2.64	7.07	22.98	5.61	2.64	0.5050	1.44	4.71E-01	2.56E-01	9.00E-02
	7.12	0.00	18.03	72.18	2.67	7.12	18.03	6.02	2.67	0.51	1.13	4.46E-01	1.92E-01	8.49E-02

TABLE I (cont.) - RANK EFFECTS: COAL STRUCTURAL CHARACTERISTICS

Coal I.D.	O/H		HEAT VAL (BTU/LB)	HEAT VAL (BTU/LB)(DAF)		MACERAL GROUPS VOL %			
						VITRINITE	INERTINITE	LIPTINITE	
PSOC 1443(I)	3.27E-01		9027.00	11332					
	3.31E-01		8937.00	11219					
	3.30E-01		8955.00	11242					
	3.21E-01								
	3.29E-01		8973.00	11264.33					
PSOC 1520(I)	3.14E-01		10220.00	11673		88.5	5.7	5.8	
	3.09E-01		9894.00	11301					
	3.10E-01		9890.00	11296					
	3.09E-01								
	3.10E-01		10001.33	11423.33					
PSOC 1468(I)	1.48E-01		13150.00	13830					
	1.48E-01		13163.00	13839					
	1.49E-01		13167.00	13832					
	1.81E-01								
	1.48E-01		13160.33	13833.67					
PSOC 1463(I)	2.20E-01		11720.00	13533		89	7.4	3.6	
	2.24E-01		11629.00	13419					
	2.23E-01		11653.00	13447					
	2.25E-01								
	2.24E-01		11670.00	13466.33					
PSOC 1461D	9.91E-02		14243.00	14729.06		84.8	7.7	7.5	
	9.67E-02		14314.00	14802.48					
	9.70E-02								
	9.93E-02								
	9.81E-02								
	9.80E-02		14278.50	14765.77					
PSOC 1461D	9.20E-02								
ORIGINAL	9.31E-02								
BOTTLE	9.72E-02								
	9.41E-02								
PSOC 1461D	1.05E-01								
OXIDIZED	1.01E-01								
BOTTLE	1.03E-01								
	1.03E-01								
PSOC 1510(I)	8.45E-02		12412.00	14949		88.6	11	0.4	
	8.60E-02		12558.00	15122					
	8.77E-02		12461.00	15008					
	8.10E-02								
	8.48E-02		12478.33	15026.33					
PSOC 1468(C)	9.84E-02								
	1.16E-01								
	1.01E-01								
	9.81E-02								
	1.03E-01								
POLYIMIDE	5.42E-01								
	5.43E-01								

TABLE I (cont.) - RANK EFFECTS: COAL STRUCTURAL CHARACTERISTICS

Coal I.D.	O/H		HEAT VAL (BTU/LB)	HEAT VAL(BTU/LB)(DAF)		MACERAL GROUPS VOL %			
	2.06E-01								
	2.08E-01								
	3.13E-01								
	6.44E-01								
	4.23E-01								

TABLE II - POLYIMIDE DATA

	A	B	C	D	E	F	G	H	I
1	Coal I.D.	Run I.D.	d1-d2, microns	Atmos.	Sample Size(mg)	Prog. T-asymp (C)	Prog. T-Dot(C/sec)	Prog. Max I, amps	Prog. Max Volts
2									
3	10.0 POLY	75	Shavings	Helium	17.4	742.5	1017	34.9	11.6
4	5.0 POLY	74	Shavings	Helium	20.8	752	987.2	35.3	11
5	2.0 POLY	73	Shavings	Helium	23.5	748.5	985.6	36.1	12.7
6	10.0 POLY	72	Shavings	Helium	19.1	640.4	970	32.8	11
7	5.0 POLY	71	Shavings	Helium	22.4	637.3	936.5	34.2	11.8
8	2.0 POLY	70	Shavings	Helium	21.3	649.4	1017.8	35.8	12.8
9	10.0 POLY	69	Shavings	Helium	16.9	541.5	970.7	33.3	10.3
10	5.0 POLY	68	Shavings	Helium	20.7	553.1	989.5	32.2	10.2
11	2.0 POLY	67	Shavings	Helium	19.7	547.3	997.3	32.9	10.3
12	10.0 POLY	66	Shavings	Helium	21.1	797	1072	38.7	13
13	10.0 POLY	65	Shavings	Helium	18.5	798.9	949.5	34.6	11.5
14	10.0 POLY	64	Shavings	Helium	18.5	818.5	898.3	33.7	11.8

	A	B	J	K	L	M	N	O	P
1	Coal I.D.	Run I.D.	Prog. Max. Pow. watt	Prog. Hold (sec)	Run T-Asym (C)	Run T-dot(C/sec)	Run Max I,amps	Run Max Volts	Run Max Pow, watts
2									
3	10.0 POLY	75	405.7	10	676.3	566.2	36.2	11.7	425.5
4	5.0 POLY	74	386.5	5	614.2	595.6	35.7	11.1	396.2
5	2.0 POLY	73	457.8	2	650.7	699.9	38	12.5	473.9
6	10.0 POLY	72	362.1	10	581.3	537.5	34.7	11	381.4
7	5.0 POLY	71	401.4	5	637.3	936.5	34.2	11.8	401.4
8	2.0 POLY	70	458.5	2	529.4	720.3	37.5	12.6	473.6
9	10.0 POLY	69	340.9	10	443.6	565.3	32.5	10.5	342.2
10	5.0 POLY	68	327.6	5	424.9	612.1	32.3	10.3	330.9
11	2.0 POLY	67	332.9	2	377.3	675.5	32.1	10.3	328.4
12	10.0 POLY	66	495.9	10	774.4	852.3	41.6	13.1	544.8
13	10.0 POLY	65	395.8	10	761.9	623.7	34.7	11.8	408.5
14	10.0 POLY	64	388.5	10	810.3	657.5	36.2	11.7	424.9

	A	B	Q	R	S	T	U	V	W	X	Y	Z
1	Coal I.D.	Run I.D.	Run Hold (sec)	% Char, Raw	% Tar, Raw	% Vol., Raw		%C-char	%H-char	%N-char	%(S+O)-char	N-char/N-Poly
2							PARENT SAMP	67.35	2.67	7.12	22.86	
3	10.0 POLY	75	10	58.6	5.7	41.4		74.74	1.98	6.72	16.56	9.44E-01
4	5.0 POLY	74	5	79.3	2.9	20.7		69.5	2.6	7.72	20.18	1.08E+00
5	2.0 POLY	73	2	71.9	3.4	28.1		72.1	2.69	7.73	17.48	1.09E+00
6	10.0 POLY	72	10	73.8	2.1	26.2		71.39	2.66	7.87	18.08	1.11E+00
7	5.0 POLY	71	5	88.4	1.3	11.6		68.68	2.82	7.57	20.93	1.06E+00
8	2.0 POLY	70	2	89.2	1.4	10.8		68.25	2.78	7.4	21.57	1.04E+00
9	10.0 POLY	69	10	94.7	1.2	5.3		68	2.66	7.39	21.95	1.04E+00
10	5.0 POLY	68	5	94.7	1	5.3		67.88	2.66	7.35	22.11	1.03E+00
11	2.0 POLY	67	2	98.5	0.5	1.5		68.17	2.63	7.36	21.84	1.03E+00
12	10.0 POLY	66	10	54.5	7.1	45.5		77.17	1.72	6.34	14.77	8.90E-01
13	10.0 POLY	65	10	55.1	6.5	44.9		76.37	1.89	6.58	15.16	9.24E-01
14	10.0 POLY	64	10	53	7.02	47		77.42	1.11	5.64	15.83	7.92E-01

TABLE II (cont.) - POLYIMIDE DATA

	A	B	AA	AB	AC	AD	AE	AF
1	Coal I.D.	Run I.D.	H-char/H-Poly	O-char/O-Poly	C-char/C-Poly	Abs CO (~2120 cm-1)	Abs CO2(~2320 cm-1)	Abs CH4 (~2995 cm-1)
2								
3	10.0 POLY	75	7.42E-01	7.24E-01	1.11E+00	2.64E-02	1.22E-01	9.35E-03
4	5.0 POLY	74	9.74E-01	8.83E-01	1.03E+00	1.96E-02	1.08E-01	0.00E+00
5	2.0 POLY	73	1.01E+00	7.65E-01	1.07E+00	2.26E-02	1.31E-01	4.10E-03
6	10.0 POLY	72	9.96E-01	7.91E-01	1.06E+00	1.90E-02	1.18E-01	0.00E+00
7	5.0 POLY	71	1.06E+00	9.16E-01	1.02E+00	9.80E-03	5.32E-02	0.00E+00
8	2.0 POLY	70	1.04E+00	9.44E-01	1.01E+00	4.05E-03	2.03E-02	0.00E+00
9	10.0 POLY	69	9.96E-01	9.60E-01	1.01E+00	0.00E+00	0.00E+00	0.00E+00
10	5.0 POLY	68	9.96E-01	9.67E-01	1.01E+00	0.00E+00	0.00E+00	0.00E+00
11	2.0 POLY	67	9.85E-01	9.55E-01	1.01E+00	0.00E+00	4.60E-03	0.00E+00
12	10.0 POLY	66	6.44E-01	6.46E-01	1.15E+00	3.29E-02	1.65E-01	1.41E-02
13	10.0 POLY	65	7.06E-01	6.63E-01	1.13E+00	2.33E-02	1.57E-01	9.80E-03
14	10.0 POLY	64	4.16E-01	6.92E-01	1.15E+00	2.73E-02	1.30E-01	1.47E-02

	A	B	AG	AH	AI	AJ	AK	AL	AM
1	Coal I.D.	Run I.D.	Abs H2O (1560 cm-1)	k values	Abs HCN (712.5 cm-1)	Abs NH3 (966 cm-1)	Abs CO/mg	Relative CO	Abs CO2/mg
2									
3	10.0 POLY	75	2.55E-02	3.40E-03	3.92E-02	2.80E-02	1.51E-03	0.97	7.03E-03
4	5.0 POLY	74	7.35E-03	4.90E-03	1.17E-02	1.31E-02	9.42E-04	0.60	5.18E-03
5	2.0 POLY	73	8.20E-03	4.10E-03	3.35E-02	1.39E-02	9.60E-04	0.62	5.58E-03
6	10.0 POLY	72	7.60E-03	3.80E-03	1.32E-02	1.46E-02	9.95E-04	0.64	6.17E-03
7	5.0 POLY	71	8.40E-03	1.40E-03	1.40E-03	2.10E-03	4.38E-04	0.28	2.38E-03
8	2.0 POLY	70	5.40E-03	2.70E-03	0.00E+00	0.00E+00	1.90E-04	0.12	9.51E-04
9	10.0 POLY	69	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00
10	5.0 POLY	68	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00	0.00E+00
11	2.0 POLY	67	1.04E-02	2.30E-03	0.00E+00	0.00E+00	0.00E+00	0.00	2.34E-04
12	10.0 POLY	66	1.41E-02	4.70E-03	2.40E-02	1.60E-02	1.56E-03	1.00	7.80E-03
13	10.0 POLY	65	9.80E-03	4.90E-03	2.50E-02	1.95E-02	1.26E-03	0.81	8.48E-03
14	10.0 POLY	64	1.58E-02	4.20E-03	1.20E-02	6.40E-03	1.48E-03	0.95	7.04E-03

TABLE II (cont.) - POLYIMIDE DATA

	A	B	AN	AO	AP	AQ	AR	AS	AT	AU	AV
1	Coal I.D.	Run I.D.	Relative CO2	Abs CH4/mg	Relative CH4	Abs H2O/mg	Relative H20	Abs HCN/mg	Relative HCN	Abs NH3/mg	Relative NH3
2											
3	10.0 POLY	75	0.83	5.37E-04	0.68	1.47E-03	1.00	2.25E-03	1.00	1.61E-03	1.00
4	5.0 POLY	74	0.61	0.00E+00	0.00	3.53E-04	0.24	5.63E-04	0.25	6.30E-04	0.39
5	2.0 POLY	73	0.66	1.74E-04	0.22	3.49E-04	0.24	1.43E-03	0.63	5.91E-04	0.37
6	10.0 POLY	72	0.73	0.00E+00	0.00	3.98E-04	0.27	6.91E-04	0.31	7.64E-04	0.47
7	5.0 POLY	71	0.28	0.00E+00	0.00	3.75E-04	0.26	6.25E-05	0.03	9.38E-05	0.06
8	2.0 POLY	70	0.11	0.00E+00	0.00	2.54E-04	0.17	0.00E+00	0.00	0.00E+00	0.00
9	10.0 POLY	69	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00
10	5.0 POLY	68	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00	0.00E+00	0.00
11	2.0 POLY	67	0.03	0.00E+00	0.00	5.25E-04	0.36	0.00E+00	0.00	0.00E+00	0.00
12	10.0 POLY	66	0.92	6.68E-04	0.85	6.68E-04	0.45	1.14E-03	0.51	7.58E-04	0.47
13	10.0 POLY	65	1.00	5.30E-04	0.67	5.30E-04	0.36	1.35E-03	0.60	1.05E-03	0.65
14	10.0 POLY	64	0.83	7.95E-04	1.00	8.51E-04	0.58	6.49E-04	0.29	3.46E-04	0.21

	A	B	AW
1	Coal I.D.	Run I.D.	Frac.Poly. N in Char
2			
3	10.0 POLY	75	5.53E-01
4	5.0 POLY	74	8.60E-01
5	2.0 POLY	73	7.81E-01
6	10.0 POLY	72	8.16E-01
7	5.0 POLY	71	9.40E-01
8	2.0 POLY	70	9.27E-01
9	10.0 POLY	69	9.83E-01
10	5.0 POLY	68	9.78E-01
11	2.0 POLY	67	1.00E+00
12	10.0 POLY	66	4.85E-01
13	10.0 POLY	65	5.09E-01
14	10.0 POLY	64	4.20E-01

END

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