CORRELATION OF STABILITY/RHEOLOGY RELATIONSHIP WITH COAL
PROPERTIES AND CHEMICAL ADDITIVES.

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FRANK OHENE
Department of Chemistry
Grambling State University
Grambling, LA 71245

Technical Project Officer
U. S. Department of Energy
Pittsburgh Technology Energy Center
P. O. Box 10940
Pittsburgh, PA 15236

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PROJECT STATUS

Four coal samples PSOC 1339, 1472, 1531 and 1527 are being used to test the fundamental relationship between coal properties and slurryability that has been established in this work. Rheological properties have have been performed on these samples using a method already described [1] .

WORK DONE.

Rheological evaluations were undertaken to include: baseline studies, effect of pH level, effect of additive type and concentration, effect of PSD on optimum CWS rheology. Slurry property analysis, (i.e. rheology as a function of temperature, constant shear and, stability) requirements were performed at key points in the test program - baseline, optimum pH level and combination of additives.

Slurry quality was determined from the ratio of the maximum amount of coal which is present in a given CWS as determined experimentally, ϕ_{m-exp} , to the maximum theoretical amount obtainable as calculated from the particle size distribution, ϕ_{m-th} .

Rheology as a Function of Temperature

The viscosity as a function of shear rate was measured at 20, 30, and 50°C or a maximum temperature tolerated by the CWS. From these tests, the effect of temperature on the Newtonian behavior of each CWS was determined. The Haake concentric cylinder viscometer was used for testing.

Stability

Static stability as a function of time was determined using a Settling Column. The shift in mass of the CWS was determined as a function of time.

Effect of Additive Type

The following additives were evaluated for their effect on slurryability in this test program:

1. Coal master A-23-S, Diamond Shamrock Chemical Co., Anionic high molecular weight condensed polynuclear hydrocarbon.
2. PC-876, West Vaco Chemical Co., ammonium lignosulfonate.
3. Combination of A-23-S and PC-876.
4. Lomar D from Diamond Shamrock
5. MCG-23A-LS from Morrison chemicals group
6. Daxad 19 from Grace corporation
7. Igepal 990 from Gaf corporation
8. A-23 from Henkel Corporation

The selection and dosage rates were determined from prior studies [1]. The additives were combined with the optimum level of the NH_4OH pH adjustor as determined from zeta potential measurements of the coals in these additives.

Results and Discussions

Rheology as a Function of Temperature

The viscosity as a function of shear rate was measured at 20, 30, and 50°C. For each coal, the viscosity decreased under all conditions tested as the temperature was increased. The

decrease in viscosity when the temperature was increased from 20 to 30°C was more significant than the increase from 30 to 50°C for all the slurries studied. Also, the CWS at 65% solids showed good stability for a period 5 days when a combination of 1:1 sodium polyanthene sulfonate and MCG-23A-LS, A-23 and Lomar D or A-23 and Daxad 19 were used as additives. The flow curves generated from the Haake viscometer using these formulated additives, had low yield points in comparison with those obtained using the pure additives. All the CWS prepared with CTAB or CTAB in combination with another additive showed very poor stability with time.

Slurries prepared with 1:1 combination of either MCG, A-23, A-23S with Daxad 19 produced lower viscosities at a shear rate of 100 compared to those containing either of the pure additives.

The rheological properties are as shown in Table 1.

Future Plans:

Rheological evaluations of CWS will continue. Also, the writing of the final technical report will begin.

REFERENCE

1. Ohene, F., Third quarterly Report. DOE/DE-FG22-88PC925 (1989).

Table 1.**RHEOLOGICAL PROPERTIES OF CWS.**COAL SAMPLE PSOC-1531 ($\Phi_{th}=76.5\%$)

Additive	R ²	n	τ_0	K	$\frac{\Phi_{exp}}{\Phi_{th}}$	η_{100} (mPas)
0.15%MCG +0.15%A-23	1.00	0.89	13.41	0.56	86%	482
0.15%MCG + 0.15% A-23S	1.00	0.93	17.52	0.82	86.3	763
0.15%MCG + 0.15 % LGS	0.99	0.61	54.34	10.43	88.9	1365
0.15%MCG + 0.15%DXD	0.97	1.4	37.2	0.06	37.2	949
0.15%MCG + 0.15%SPS	0.97	0.92	0	1.18	92.3	635
0.15%MCG + 0.15%SPS	0.99	1.12	3.24	0.24	87.7	421
0.15%MCG + 0.15%CTAB	1.00	0.64	0	1.14	85.8	220
0.15%MCG + 0.15%LD	0.99	0.85	4.02	.35	86.1	214.6
0.15%A23 + 0.15A23S	0.98	0.39	0	3.76	85.7	223.1
0.15%A23 + 0.15%LS	1.00	0.7021	0	0.88	84.4	226.8
0.15%A23 + 0.15%CTAB	0.97	0.6472	0	0.76	85.6	147.9
0.15%A23 + 0.15%SPS	1.00	1.008	0	6.75	85.9	207.1
0.15%A23 + 0.15%DXD	1.00	1.048	2.12	0.138	86.6	183
0.15%A23 + 0.15%LD	0.99	1.173	0.69	0.886	88.1	183.5
0.15%A23 +						

0.15%LD	0.98	1.222	4.39	0.0317	89.4	139.2
0.3% MCG	0.98	1.16	5.92	0.023	82.4	85.4
0.3% A23	0.98	1.04	3.44	0.067	78.95	92.7
0.3% A23-S	0.94	0.95	1.17	0.02	75.8	68.0
0.3% A23-S	1.00	0.87	13.54	0.58	86.9	467

END

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