PLAINTIFF'S EXHIBIT

MAR-313

PHYSICAL PROPERTIES OF CARBON BLACK DETERMINE WHICH BLACK PERFORMS BEST

In selecting a carbon black, several factors must be considered to determine which black will perform best in a given application. These factors are based on the physical properties of the carbon black.

The following outline is presented to serve as a guide in selecting the carbon black which will have the physical properties that give the desired end results in a particular application.

1 particle size

The particle size of carbon black is measured by the electron microscope and will range from 70 millimicrons for a coarse furnace black of the MOLACCO type to 10 millimicrons for a fine channel black such as ROYAL SPECTRA. It is this property which determines the mass color and tinting strength for a particular grade of carbon black. Mass color variations can be seen by preparing dispersions of carbon black in mineral oil, and then by direct visual observation under a strong light, comparing the mass color of adjacent drawdowns on a microscope slide. Tinting strength is the ability of a carbon black to hide a white pigment such as zinc oxide. This value is reported as a percentage compared to a predetermined grade of black.

2 structure

A second property of carbon black is its tendency to form either chain- or grape-like aggregates. An indication of the degree of structure or length of aggregate chain is obtained from Stiff Paste oil absorption determinations, along with an estimate of surface area from either a blackness index or electron microscope rating. While particle size is the primary property related to mass color, structure plays a secondary role in mass color development. As structure increases at a constant particle size, color is depressed due to a decrease in carbon surface area.

The property of structure affects a carbon black's ability for electrical conductivity. High structure carbons provide reticulate chains of carbon particles which form almost continuous paths through a medium.

3 surface chemistry

Surface activity, pH, and percentage volatile are all part of the carbon black particle's surface chemistry. In the channel process, volatile is added by thermal oxidation which in turn produces an acid pH effect. Furnace processed carbon blacks are categorized by their low volatile and resulting neutral pH. Several furnace blacks have been engineered which offer desirable rheological and adsorption properties, due to their unique chemical surface. When an ink exhibits low viscosity and yield values, it shows long flow properties. The degree of flow is directly related to the volatile content per unit surface area for a black of particular particle size and structure level.

As the percentage of volatile on the surface increases, the specific adsorptive activity will correspondingly increase. An index for the amount of total surface activity of a carbon black particle is determined by a Diphenyl Guanidine Adsorption test. Advances in carbon black technology have made possible furnace blacks of the RAVEN type, which have good color along with the neutral pH and low surface activity typical of the method of manufacture.

ROYAL SPECTRA® Coatings: The blackest of blacks for highest quality. (C)
NEO SPECTRA® MARK I Coatings: Intermediate in blackness between Royal Spectra and Neo Spectra Mark II. (C)
NEO SPECTRA MARK II Paints: Standard black for top-quality enamels and lacquers. **Plastics:** High color and gloss. (C)
NEO SPECTRA AG Paints: Antigelation type for cocoanut alkyd, acrylics, etc. High color, low viscosity for quality enamels. (C)
NEO SPECTRA TA BEADS Paints: Thermo-setting and thermoplastic acrylic. High color at low viscosities. (C)
SUPER SPECTRA® Enamels and Lacquers: High blackness. Satin finish for Leather Coatings. (C)
SUPERBA® General Purpose: Medium high color black for paints, enamels, plastics, etc. (C)
NO. 999 Coatings: Intermediate black. **Plastics:** Standard for ultra violet screening. Electrical. High resistivity. (C)
RAVEN® 2000 Coatings, Plastics: Highest color furnace black at low oil absorption. (F)
RAVEN® 1800: Coatings, Plastics: Next highest color furnace black at higher oil absorption. (F)
RAVEN® 150 Coatings: Low viscosity and lack of surface activity for acid sensitive vehicles. **Inks:** Low viscosity for flexo and gravure inks. Suited for emulsion vehicles. (F)
RAVEN 50 Coatings: Low viscosity and lack of surface activity. Neutral surface for good stability in emulsion vehicles. Good color and tone at moderate price. (F)
RAVEN 1200 Inks: Low viscosity and lowest abrasive furnace black. Easy dispersing. (F)
RAVEN 40 Paints and Inks: Higher color than Raven 11 in organics. Low vehicle demand, blue tone. (F)
PEERLESS 155 Inks: Long flow, low viscosity, blue tone, low oil absorption, low adsorption, high tinting strength. Unequaled combination of flow, color, strength. (F)
RAVEN 35 Inks: Publications, general purpose inks, carbon papers. Medium flow, low vehicle demand, high tinting strength. **Paints:** General utility and low viscosity paints. (F)
RAVEN 30 Paints, Inks, Plastics: General all purpose black, high strength, low vehicle demand. (F)
RAVEN 1000 Inks: Low viscosity and low abrasion furnace black. Easy dispersing. Good color and strength at a moderate price.
STATEX® F-12 Inks: Standard news ink black for greater density of blackness, better "lay", blue tone; (oil beads available). **Paints:** Low cost industrial paints. (F)
STATEX B-12 Paints: For chassis blacks, single pigment grays, tints. **Inks:** All types of inks and carbon papers. Blue tone, good density, "lay", low oil absorption. **Plastics:** For tinting, paper, paper board, etc. (F)
STATEX Inks: All types of inks, including engraving inks, and carbon papers. Pleasing blue tone, low oil absorption and good density. **Paints:** For blue grey tints, dark machinery greys. **Plastics:** Good tinting black. (F)
MOLACCO® LS Inks: Carbon paper inks, blue tone, low oil absorption. **Coatings:** Tinting pastes, polyolefins, polyurethanes, utility enamels. Good color with blue tone. (F)
MOLACCO H Inks and Coatings: High structure, low oil absorption, good tinting. (F)
MOLACCO Inks and Coatings: Lowest in color. Blue tone. (F)
CONDUCTEX® 850: Highest electrical conductivity. (F)
CONDUCTEX® SC High electrical conductivity at lower cost. (F)
STATEX® 160-W Plastics, Wire & Cable: SAF furnace black meets Western Electrical Material Specification 57924, Issue #4.
COLOIDEX® #5 Cements, Paper, Aqueous Coatings: High electrical resistivity; good tinting black. (F)
STATEX FT: Low cost. Large particle size. High loading fillers. (T)
STATEX MT: Low cost. Larger particle size. High loading fillers. (T)
(C)—Channel Process (F)—Furnace Process
(T)—Thermal Process

QUALITY CHECK PROCEDURE

MILLING:
Szegvari 1S Attritor
18Kg 3/16" dia. steel balls
2Kg 108 powder
2Kg water
200 RPM
Run for approximately 4 hours to achieve an average particle size of 0.80-0.85 microns as measured with a Fisher Sub-sieve Sizer using a 5.4 gram sample.

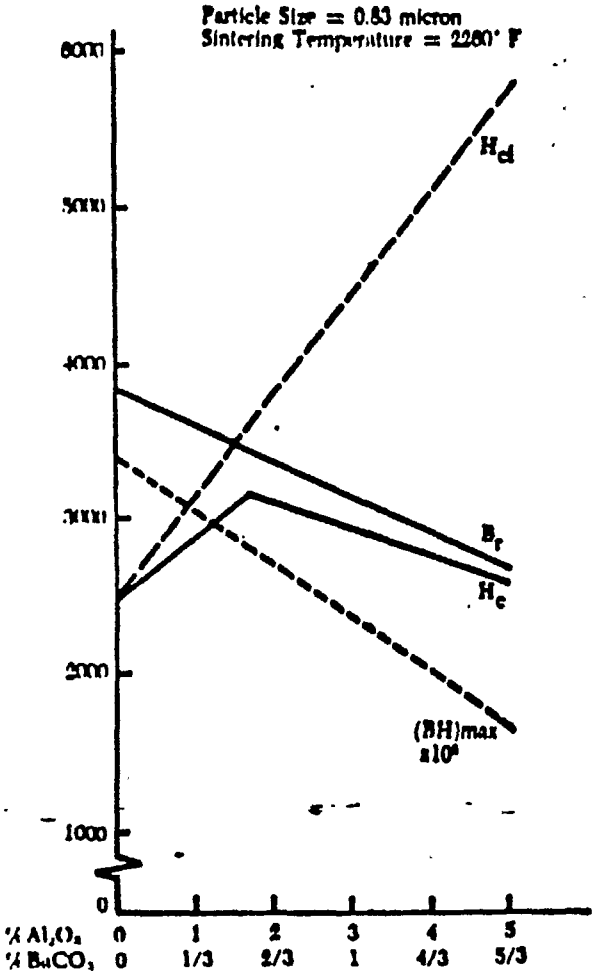
PRESSING:

Slurry Specific Gravity	1.69
Orienting Field	10,000 Oersteds
Final pressing tonnage	5000 psi
Dry Green Density	2.75 - 2.85 G/cc

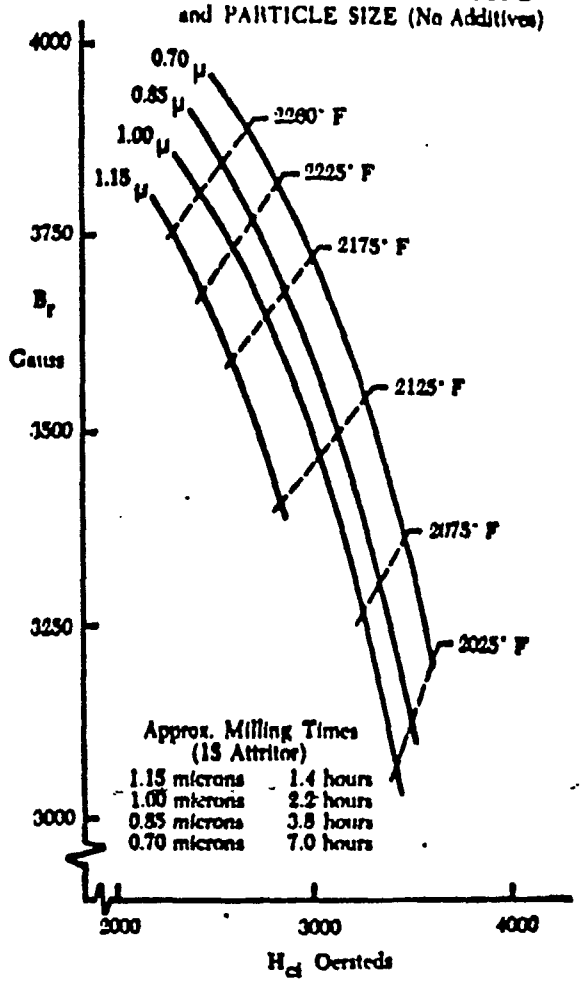
SINTERING:

Heating Rate	300° F/hr
Peak Temperature	2260° F - 1.5 hour soak
Cooling Rate	600° F/hr

MAGNETIC PROPERTIES
vs. Al_2O_3 + $BaCO_3$ ADDITIONS[1]
Particle Size = 0.83 micron
Sintering Temperature = 2260° F



MAGNETIC PROPERTIES
vs. SINTERING TEMPERATURE
and PARTICLE SIZE (No Additives)



Approx. Milling Times
(1S Attritor)

1.15 microns	1.4 hours
1.00 microns	2.2 hours
0.85 microns	3.8 hours
0.70 microns	7.0 hours

[1] A six to one molar ratio of Al_2O_3 plus $BaCO_3$ is recommended as an additive to modify the magnetic properties of #108 ferrite since this combination leads to optimum magnetic properties with minimum shrink variation. Write for further details.