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KREBS PIGMENTS DEPARTMENT
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NEWARK, NEW JERSEY

NEWARK PLANT
PIGMENT COLOR RESEARCH REPORT

Final Report

COMBUSTION DATA

CHROME YELLOWS, CHROME GREENS, IRON BLUES

Period Covered:

1947-1948

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DATE: Aug. 19, 1948

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NEWARK PLANT

PIGMENT COLOR RESEARCH REPORT

Final Report

TITLE: COMBUSTION DATA
CHROME YELLOWS, CHROME GREENS, IRON BLUES

PERIOD COVERED: 1947-1948

CHARGE: BCN - 3, 4 and 5.

SUBMITTED BY: *E. F. Klenke, Jr.*
E. F. KLENKE, Jr.

DATE SUBMITTED: 6/29/48

APPROVED BY: *J. O. Morrison*
J. O. MORRISON
Aug 19, 1948

DATE ISSUED: Aug. 19, 1948.

INTRODUCTION:

This report summarizes data accumulated during the past two years relative to the ignition temperatures and other combustion properties of Chrome Yellows, Chrome Greens, and Iron Blues. These data were developed in conjunction with the work on dry blending of Chrome Greens and the non-dusting treatment of Iron Blues.

SUMMARY AND CONCLUSIONS:

Most of the work done concerned the G-604-D line of Chrome Greens and its yellow component Y-572-D since several fires occurred in the grind shop while processing these materials.

Laboratory tests indicate the combustibility of Y-572-D to be due to the presence of Ammonium Naphthenate and Para Soap which are used as texture treating agents. Standard treated material was found to burn at 356°F whereas a sample from a lot (58645) made without Naphthenate or Para Soap had not burned at 450°F.

Ignition temperatures of the G-604-D line of greens ranged from 340°F (G-604-D and G-605-D) to 450°F (G-648-D). Samples of a G-605-D mix, made using the untreated Y-572-D (lot 58645) as the yellow component, ignited at 435°F - or almost 100° higher than the standard type G-605-D.

Samples of Y-561-D, the yellow component of the G-550-D line of greens, could not be ignited. When treating agents (Naphthenic acid, Para Soap, Turkey Red Oil) were added to the dry Y-561-D, however, ignition occurred (only the treating agents seemed to burn in these cases). Test conducted with samples of G-550-D and G-553-D confirmed this since their combustion points were 400°F and 440°F respectively.

Tests conducted on samples of continuous process chrome yellows showed that the Light Yellows Y-404-D and Y-405-D could not be ignited even though they contained 1% Petronate. Medium Yellow Y-469-D containing more than 0.5% Petronate burned at 285°F; Y-469-DS and Y-424-D did not burn.

Previous evaluation of B-216-D and non-dusting B-278-D (Mentor 29 treated B-216-D) tested both as blues and greens (G-553-D) each gave ignition points of 430° - 450°F.

In summarizing these results the following conclusions may be drawn:

1. The use of Petronate (0.5% or more) Para Soap, Naphthenic Acid or Para Soap as treating agents for Chrome Yellows causes a lowering of the ignition temperatures.

- 2 - Medium Yellows (89% or more Lead Chromate) containing more than 0.5% Petronate will burn at 285°F.
- 3 - Light Yellows (containing about 60-70% Lead Chromate and 30-20% Lead Chromate, respectively) will not burn even when treated with 1% Petronate. The Petronate does decompose, however, causing a discoloration of the pigment.
- 4 - Shading Yellow Y-561 acts in the same manner as the Light Yellows (3).
- 5 - Shading Yellow Y-572 burns violently at 356°F
- 6 - Shading Yellow Y-572, made without the standard Naphthenate and Para Soap does not burn below 450°F.
- 7 - The G-550-D line of Greens is not combustible below 450°F (When the blue component is non-dusting B-216-D, the ignition temperature is 430°F for G-553).
- 8 - The G-604-D line greens burn in the range 340°-450°F
- 9 - Non-dusting B-278-D (contains +7% Mentor) burns at 440° (the same as untreated B-216-D).

EXPERIMENTAL DETAILS:

The data accumulated during this study are filed in DSN-48-8.

REFERENCE:

KN-47-25.

UNDERWRITERS' LABORATORIES, INC.

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NC-330
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May 26, 1947.

E. I. Du Pont de Nemours & Co., Inc.
Wilmington, Delaware.

Attention: Mr. H. L. Miner, Manager
Safety and Fire Protection Division
Your File OH-332

Gentlemen:

In compliance with your letter of April 24, 1947, addressed to Mr. A. F. Matsch, we have conducted dust-explosion tests and ignition temperature tests on two samples of dry powder colors submitted by you. These samples, marked "G-550-D" and "G-553-D", were stated by you to be chrome green produced by mixing iron blue with lead chromate. Following is our report giving the test methods employed and the results obtained, together with our comments thereon.

DUST-EXPLOSION TESTS:

METHOD

Dust-explosion tests of these pigments, including determination of the approximate lower limit of flammability of the dust in air, were conducted in a small bomb of the modified Clement-Fraser type (1400-cc capacity), using a barium peroxide-magnesium pellet source of ignition. This apparatus, and the test procedure, are described in our report to you, NC-330, dated March 14, 1941 (your File OH-331.2).

RESULTS

Dry color powder "G-550-D" when disseminated in air in the small bomb in concentrations ranging from 0.100 to 3.000 oz. per cu.ft. did not propagate flame (explosion) beyond the vicinity of the source of ignition. In all explosion tests of this powder, the pressure developed within the bomb was less than 1/2 psi.

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Dry color powder "G-553-D" is definitely capable of propagating flame when disseminated in air in sufficient quantities in the presence of a source of ignition. The lower limit of flammability of this dust in air is approximately 0.025 oz. per cu.ft. (25 mg per liter). Explosion pressures developed during the tests are shown in Table I. The explosion pressure increased with the concentration of dry powder color "G-553-D" disseminated in the bomb, due perhaps to the oxidizing effects of the lead chromate as well as reaction with oxygen of the air. Somewhat higher explosion pressures would therefore be expected to be developed by concentrations of "G-553-D" in excess of 2.0 oz. per cu.ft., but it will be noted that pressures developed in explosion tests of this dust in the small bomb are not necessarily the maximum pressures which may be encountered during explosions of the dust in industrial buildings and equipment. The pressures obtained in the bomb are within the range capable of causing damage to many types of building construction. In explosions of a dust, the pressure is a function of the degree of sub-division of the dust and its concentration in air, and is influenced by the form and dimensions of the enclosure, the initial temperature, pressure and turbulence.

IGNITION TEMPERATURE TESTS:

METHOD

The ignition temperature (autogenous) of the dry powder colors was determined by dropping varying amounts (up to 25 grams) of the powders into a glass flask surrounded by a solder bath which was heated at a constant temperature during the test by a thermostatically controlled electric furnace. The flask was of conical form with flat bottom, 4-1/2 in. (11.4 cm) in height, 2-3/8 in. (6.0 cm) in diameter at bottom, and 1-1/8 in. (2.8 cm) in diameter at top. It was of about 160 ml capacity, (rated capacity 125 ml) having a ratio of surface area to volume of about 1.1. The temperature of the solder bath was measured by a calibrated thermocouple provided with a quartz tube to protect the hot junction.

The minimum temperature at which ignition occurred under the above conditions was considered as the autogenous ignition temperature.

RESULTS

The autogenous ignition temperature of dry powder color "G-550-D" was found to be 217 C (422.6F). The autogenous ignition temperature of dry powder color "G-553-D" was found to be 188 C (370.4 F).

NC-330

May 26, 1947

Some ignition tests of each powder were also conducted in which a small conical pile of powder was made over a small coil of Chromel wire, the coil being completely covered by powder. Pre-determined voltage, sufficient to heat the Chromel wire to bright glowing, was then applied to the coil. Under these conditions, powder "G-550-D" ignited and burned with dull-red glowing. Powder "G-553-D" burned somewhat more slowly than "G-550-D", but there was more brilliant glowing and occasional bursts of sparks approaching deflagration.

Although dry powder color "G-553-D" is more likely to propagate flame when disseminated in air in the presence of a source of ignition than is "G-550-D", both materials are combustible and in the form of piles are capable of burning if ignited.

If there are any questions on the foregoing, please do not hesitate to write us.

Yours very truly,

R. E. DUFOUR
Asst. Chemical Engineer

Tests by:
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