GRANT # DEFG 01-94CEI502

QUARTERLY REPORT

MAY 1, 1996-AUGUST 1, 1996
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As outlined in the last quarterly report, this quarter we focused on the preparation and testing of Miragloss clay and Brazilian clay as copigments.

Figures 1 and 2 show that about 3 points higher brightness, either calendered or uncalendered, is obtained at the 2.25, and 30% TiO2 level using the layered pigment vs the loose blend of the same pigments.

Figures 5-28 illustrate the coatweight-brightness relationships for both layered pigments and controls for Miragloss and Miragloss 91 pigments. These data are summarized at a coatweight of 3.5 lb./1000 sq. ft. in Figures 3 and 4. Both uncalendered and calendered, layered pigments provide a 2 point improvement in brightness. This relates to either the elimination of calcined clay or the reduction of TiO2 in recycled or natural kraft paperboard.

During this quarter we also prepared dispersions of layered pigments for scanning electron microscopic analysis. Results clearly show a layering effect of TiO2 on to clay as well as much less flocculation of TiO2 than in the controls.

During this period a presentation of this technology was given to Engelhard Minerals and Chemical Corporation. It was followed by signing a developmental license for evaluation and possible commercialization. Subsequently, 4 Kg batches of 3 layered pigments containing 20, 25, and 30% TiO2 with the balance being Miragloss 91 clay were prepared. They were lab tested in paperboard coatings vs a simple blend of TiO2 and Miragloss 91 clay. Results indicated no improvement in optics on the uncalendered samples. This is contrary to our earlier experience. We have identified that this is due to starting with slurry Miragloss 91 rather than the same clay spray dried. We do not yet understand yet why the slurry clay outperformed the spray dried clay in the controls. During the next quarter we will focus on this critical issue which is central to developing a long term license with Engelhard for commercialization.
UNCALENDERED BRIGHTNESS: COATED ON PRECOATED MEAD BOARD

Coatings contain 4 pph Procote 400 and 17 pph Dow 620
CALENDERED BRIGHTNESS: COATED ON PRECOATED MEAD BOARD

Coatings contain 4 pph Procote 400 and 17 pph Dow 620
CALCULATED BRIGHTNESS VS % TIO2: COATED ON PRECOATED NATURAL KRAFT
UNCALENDERED BRIGHTNESS VS % TiO2: COATED ON PRECOATED NATURAL KRAFT
@ 3.5 lbs/msf
UNCALENDERED BRIGHTNESS: COATED ON PRECOATED NATURAL KRAFT

20% TiO2 + 80% Miragloss
UNCALCERED BRIGHTNESS: COATED ON PRECOATED NATURAL KRAFT

\[ 25\% \text{TIO}_2 + 75\% \text{Miragloss} \]
UNCALENDERED BRIGHTNESS: COATED ON PRECOATED NATURAL KRAFT

![Graph showing brightness vs. coatweight](image-url)

- ■ 30% TiO2 + 70% Miragloss
UNCALENDERED BRIGHTNESS: COATED ON PRECOATED NATURAL KRAFT

- 25% TiO2 + 75% Miragloss 91
UNCALENDERED BRIGHTNESS: COATED ON PRECOATED NATURAL KRAFT

- Brightness values: 77.5, 78, 79, 79.5, 80, 80.5, 81, 81.5, 82, 82.5
- Coatweight range: 2 to 4.5 lbs/msf

Marked points corresponds to 30% TiO2 + 70% Miragloss 91.
UNCALENDERED BRIGHTNESS: COATED ON PRECOATED NATURAL KRAFT

COATWEIGHT (lbs/msf)

BRIGHTNESS
UUNCALCULATED BRIGHTNESS: COATED ON PRECOATED NATURAL KRAFT
UNCALENDERED BRIGHTNESS: COATED ON PRECOATED NATURAL KRAFT

COATWEIGHT (lbs/msf) vs. BRIGHTNESS

- T b 30 M91
CALENDERED BRIGHTNESS: COATED ON PRECOATED NATURAL KRAFT

COATWEIGHT (lbs/msf) vs. BRIGHTNESS

- 20% TiO₂ + 80% Miragloss
CALENDERED BRIGHTNESS: COATED ON PRECOATED NATURAL KRAFT

- Brightness values range from 73 to 77.
- Coate weight values range from 2 to 4 lbs/msf.
- The graph plots brightness against coate weight, showing data points for 25% TiO2 + 75% Miragloss.
CALENDERED BRIGHTNESS: COATED ON PRECOATED NATURAL KRAFT

□ 30% TiO₂ + 70% Miragloss
CALENDERED BRIGHTNESS: COATED ON PRECOATED NATURAL KRAFT
CALENDERED BRIGHTNESS: COATED ON PRECOATED NATURAL KRAFT

![Graph showing brightness vs. coatweight for coated paper. The graph includes data points for 20% TiO2 + 80% Miragloss 91.]
CALENDERED BRIGHTNESS: COATED ON PRECOATED NATURAL KRAFT

- 25% TiO2 + 75% Miragloss 91
CALENDERED BRIGHTNESS: COATED ON PRECOATED NATURAL KRAFT

![Graph showing brightness vs. coatweight for 30% TiO2 and 70% Miragloss 91]
CALENDERED BRIGHTNESS: COATED ON PRECOATED NATURAL KRAFT

![Graph showing brightness versus coating weight](image-url)