SOUTHERN CLAY PRODUCTS
A ROCKWOOD® SPECIALTIES, INC. COMPANY

High Performance, High Stability, High Consistency Additives for Solvent Based Asphalt Formulations

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by

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ROCKWOOD ADDITIVES

The bulk of solvent based asphalt systems that use rheology modifiers today use an in-situ process that employs attapulgite and PA-14 acetate surfactant.

This approach has been used for many years, but there are performance issues the industry has been forced to accept for a number of reasons.

Recent evaluations and analyses of these systems have found a reasonable alternative technology which will be presented today.

Rheology modifiers generate a number of desirable performance properties in solvent based asphalt systems:

- Anti-settling
- Anti-separation (syneresis control)
- Sag and flow control
- General thickening

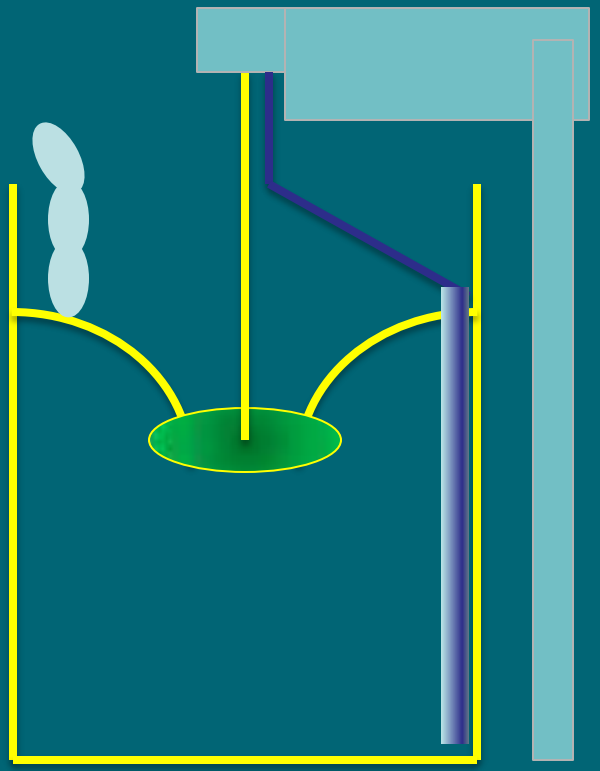
Current technology, while no doubt familiar to manufacturers has been widely reported to have measurable real world problems:

- Inconsistent in-plant viscosity reproducibility
- Field returns due to settling
- Field returns due to separation
- Application issues and field returns due to poor viscosity stability

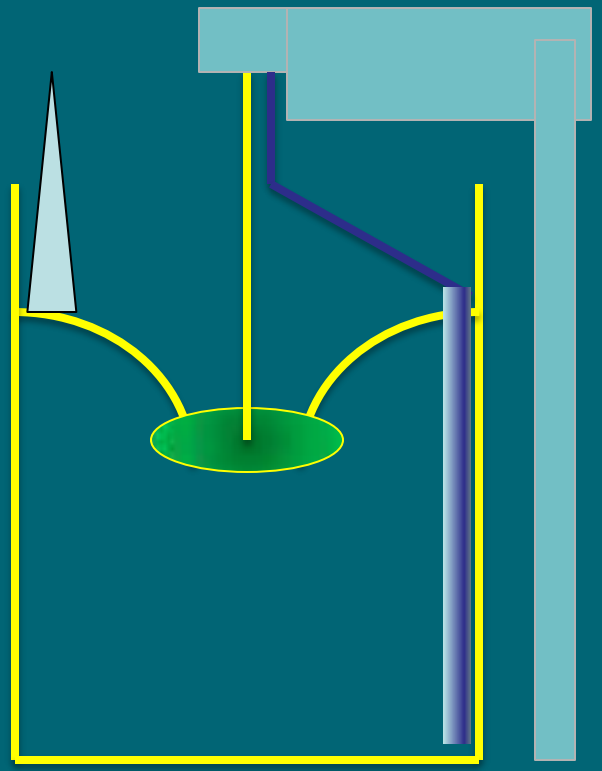
A simple analysis of known variables in the formulated product gives significant insight into the source of the problems:

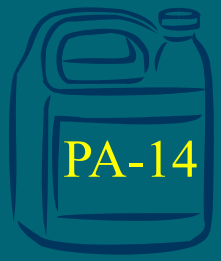
- Attapulgite can be of 80 to 100% purity
- Attapulgite can have from 2% to 14% moisture
- PA-14 Acetate, while nominally 100% active, can have some impurities
- Order of addition and shear conditions are not always tightly controlled

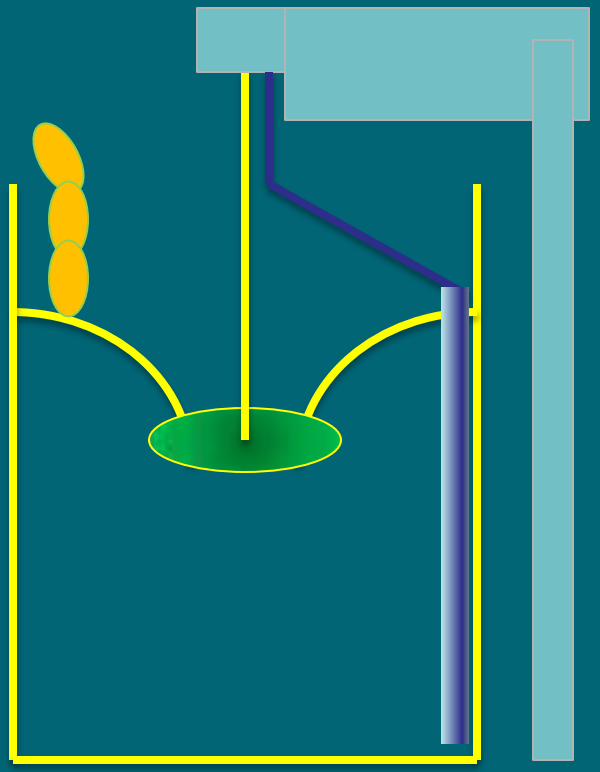
Solvent/Cutback



Pigment/Inerts




PA-14



Issues that can arise because of manufacturing variations:

- Variations in the degree of mixing/shear
- Variations in the time of mixing
- Variations in the time between materials being added
- Order of addition variations

Issues that can arise because of manufacturing variations:

- Variations in the degree of mixing/shear

1) Inadequate shear:
   a) Poor solubilization of cutback
   b) Poor dispersion of attapulgite ★
   c) Inadequate wetting/dispersion of inerts/pigments
   2) Over-shear:
   a) Degradation of attapulgite ★

Issues that can arise because of manufacturing variations:

- Variations in the time of mixing

1) Inadequate mixing:
   a) Post wetting of inerts/pigments
   b) Inconsistent adsorption of PA-14 on to attapulgite ★
   2) Over-mixing:
   a) Excess temperature can raise solids
   b) Excess temperature can speed rate of PA-14 adsorption ★

Issues that can arise because of manufacturing variations:

- Variations in the time between materials being added

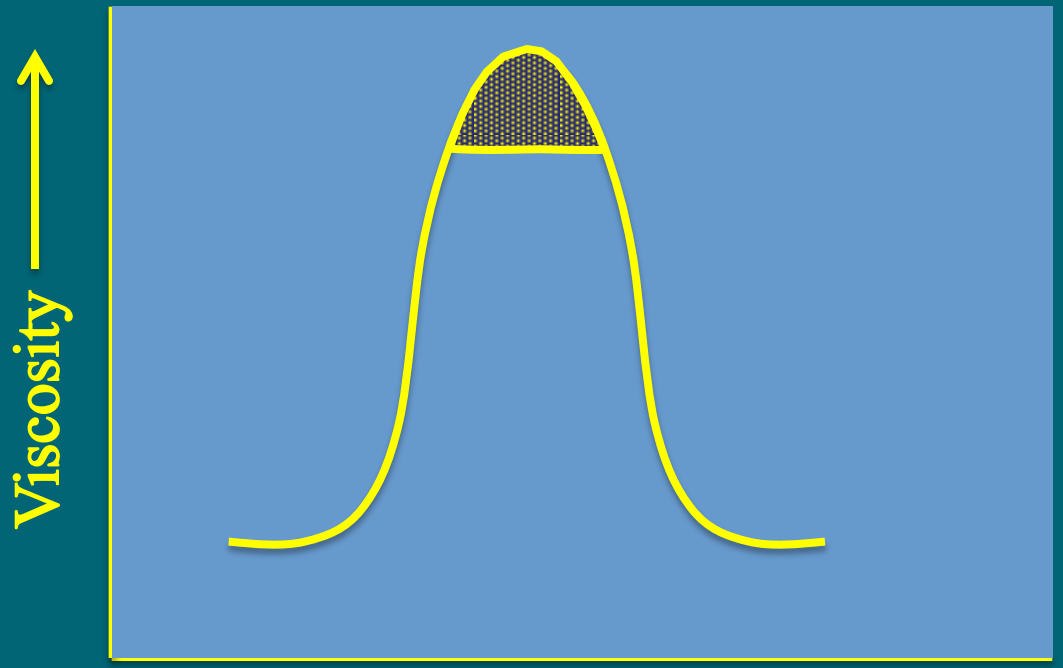
1) Attapulgite
   a) Insufficient time before addition of PA-14 can result in poor dispersion and poor reaction of PA-14 to attapulgite.
   b) Insufficient time after addition of PA-14 can result in PA-14 reacting to other materials in formulation

Issues that can arise because of manufacturing variations:

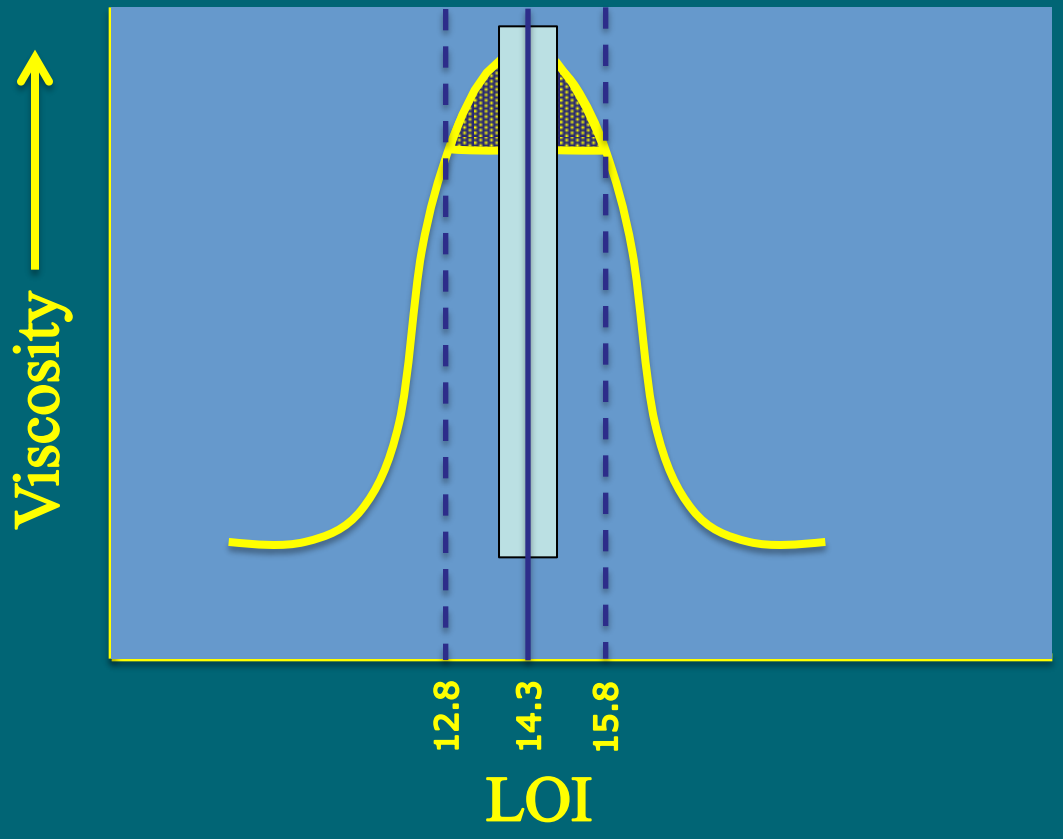
- Order of addition variations

1) Early addition of PA-14 can result in PA-14 encapsulating attapulgite and other inerts and preventing dispersion
2) Late addition of PA-14 can result in PA-14 adsorbing onto surfaces other than attapulgite.
3) Late addition of attapulgite can lessen degree of dispersion.

Organoclay Treatment Optimization



Typical Attapulgite/PA-14 Treatment



IDEAL

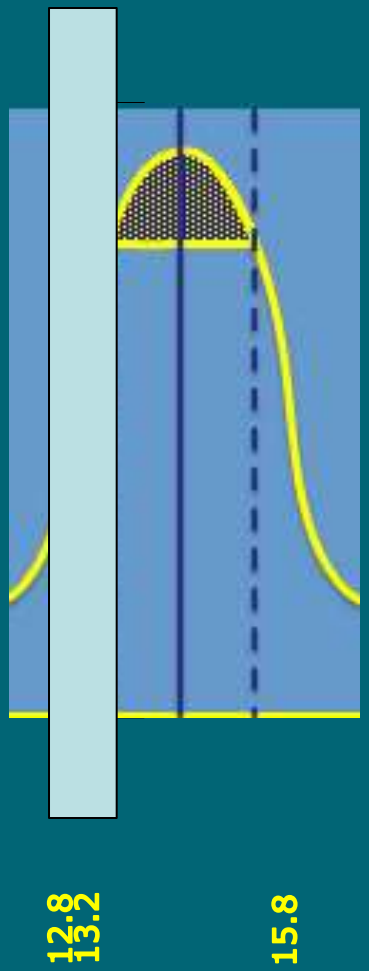
5.5 gms. clay
* .90 solids
4.95 dry grams
* .85 purity
4.20 grams attapulgite

Treated with 0.7 gms.
100% PA-14

0.7/4.9 = 14.3

Typical natural variability due to other species being present in mix ± 0.5 units

Attapulgite/PA-14 Treatment Variation 1



Variation 1
Low Moisture Clay

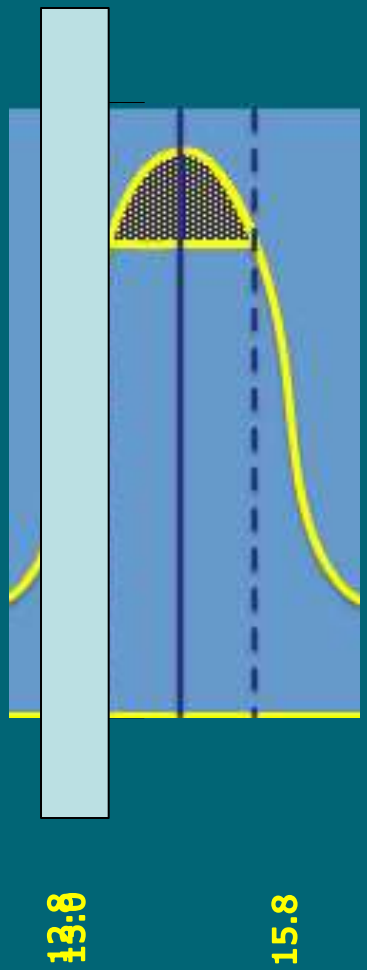
5.5 gms. clay
* .98 solids
5.40 dry grams
* .85 purity
4.60 grams attapulgite

Treated with 0.7 gms.
100% PA-14

0.7/5.3 = 13.2

+ poor initial dispersibility

Attapulgite/PA-14 Treatment Variation 2



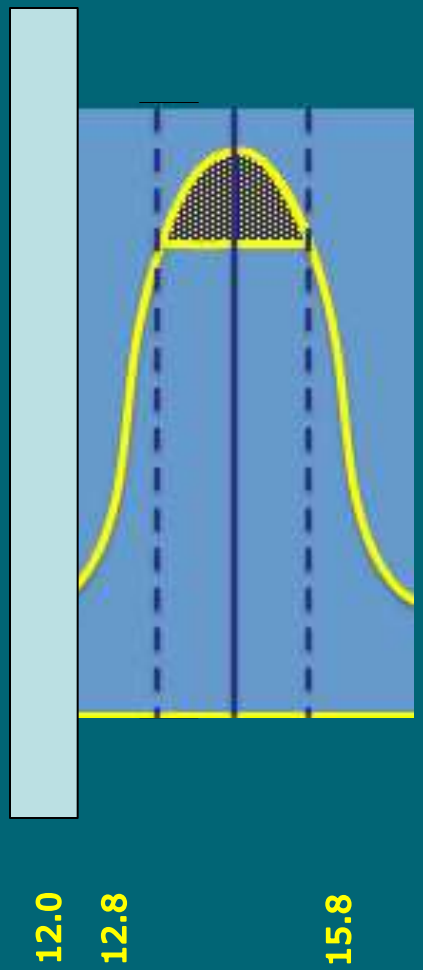
Variation 2
High Purity Clay

5.5 gms. clay
* .90 solids
4.95 dry grams
* .95 purity
4.70 grams attapulgite

Treated with 0.7 gms.
100% PA-14

0.7/5.4 = 13.0

Attapulgite/PA-14 Treatment Variation 1+2



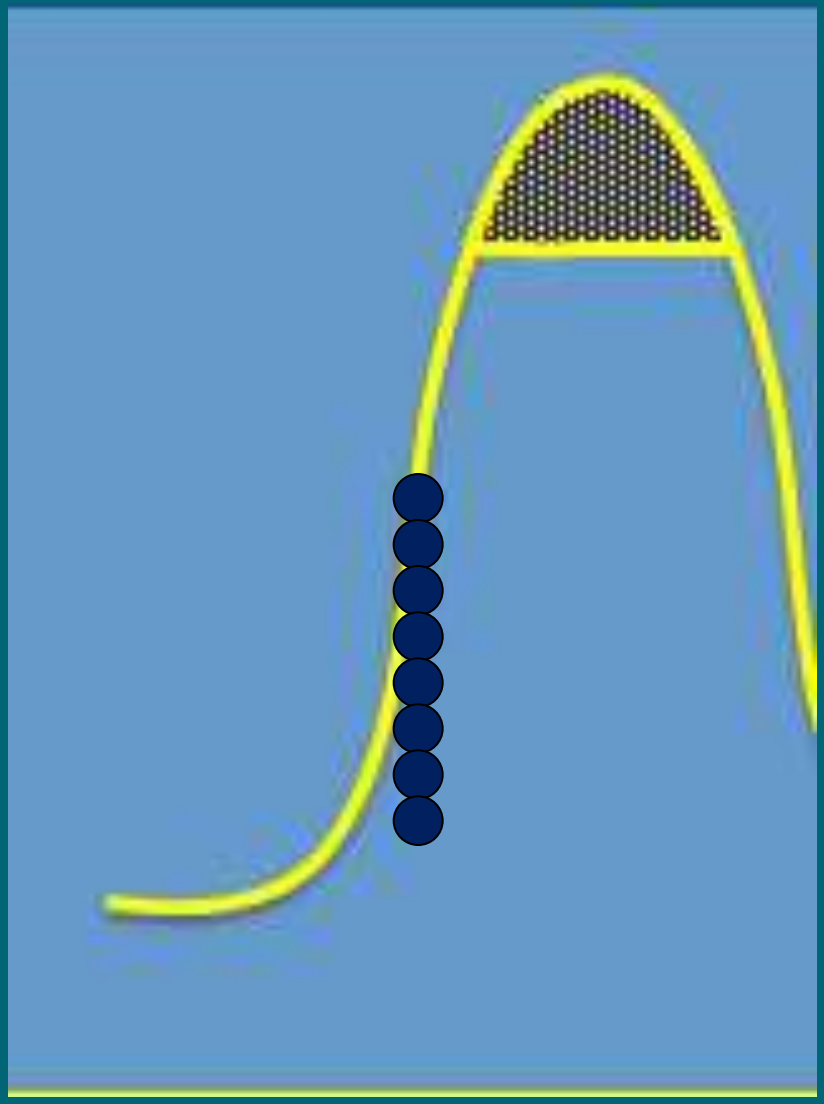
Variation 1+2
High Purity Clay
With Low Moisture

5.5 gms. clay
* .98 solids
5.40 dry grams
* .95 purity
5.12 grams attapulgite

Treated with 0.7 gms.
100% PA-14

0.7/5.82 = 12.0

Attapulgite/PA-14 Treatment Variation 1+2



Poor dispersion of attapulgite

Degradation of attapulgite

Inconsistent adsorption of PA-14 on to attapulgite

Excess temperature can speed rate of PA-14 adsorption

Insufficient time before addition of PA-14 can result in poor dispersion and poor reaction to attapulgite.

Insufficient time after addition of PA-14 can result in PA-14 reacting to other materials in formulation

Early addition of PA-14 can result in PA-14 encapsulating attapulgite and other inerts and preventing dispersion

or

Late addition of PA-14 can result in PA-14 adsorbing onto surfaces other than attapulgite.

Is there a solution?

YES!

Organoclays

Quat to actual clay ratio tightly controlled.

Moisture tightly controlled.

Manufacturing processes optimized.

Little variability from other ingredients.

Reduction in use level up to 40%.

Organoclays

Quat to actual clay ratio tightly controlled.

± 1.5 LOI units

Organoclays

Moisture tightly controlled.

2.0 – 4.0%.

Organoclays

Manufacturing processes optimized.

Organoclays are always predispersed in solvent and/or cutback

Organoclays

Little variability from other ingredients.

Quat is pre-reacted to clay so there is no competition from other inerts and pigments.

Organoclays

Reduction in use level up to 40%.

Organoclays are highly efficient and highly effective with little concern about stability.

Organoclays vs. Attapulgite/PA-14

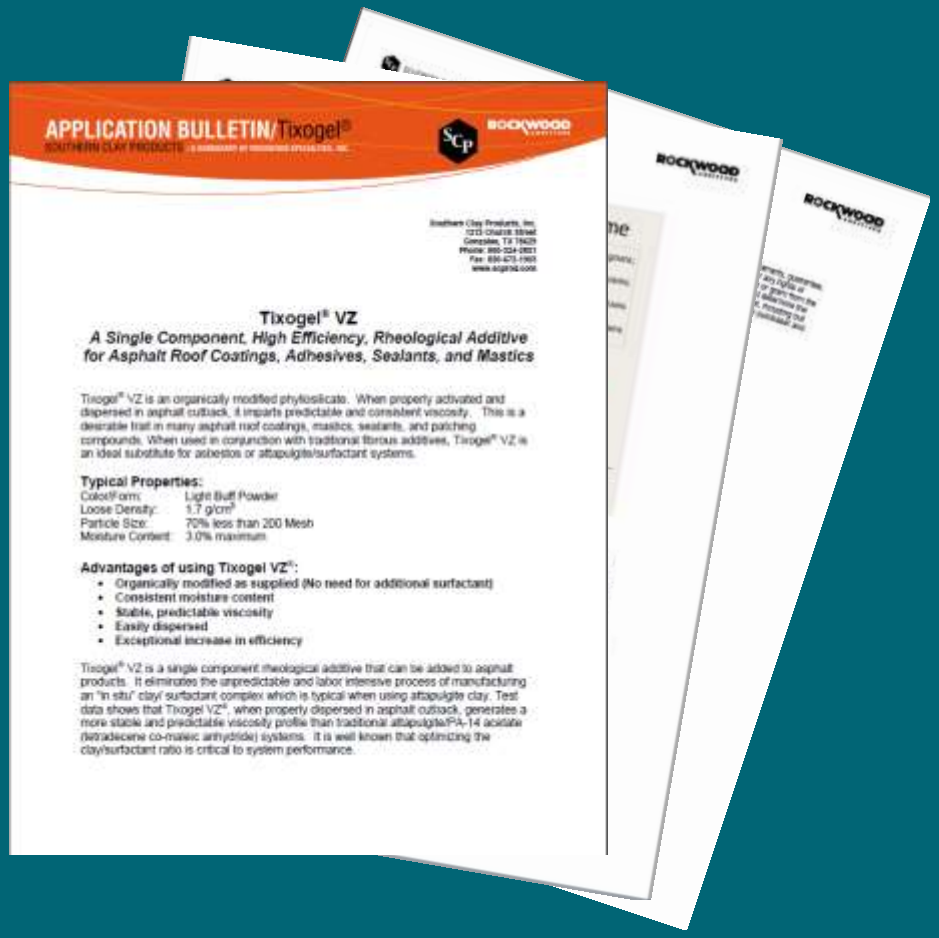
Performance	
Initial Viscosity	
Attapulgite + PA-14	150,000 cps.
Organoclay 1 + Polar Activator	110,000 cps.
Organoclay 2	130,000 cps.
4 Week Stability	
Attapulgite + PA-14	- 15%
Organoclay 1 + Polar Activator	+ 8%
Organoclay 2	+18%

Dosing Information	
Attapulgite	21.0 gms.
PA-14	2.5 gms.
vs.	
Organoclay 1	14.6 gms.
Polar activator	4.4 gms.
or	
Organoclay 2	11.3 gms.
Polar activator	0.0 gms.

Organoclays vs. Attapulgite/PA-14
Other Advantages

- ✓ Reduction in crystalline silica up to 85%.
- ✓ Global sales force.
- ✓ Global distribution network including all 50 states.
- ✓ Dedicated technical development facilities for coatings in Texas and Kentucky.

Available Product Information


APPLICATION BULLETIN/Tixogel®

SOUTHERN CLAY PRODUCTS

Tixogel® VZ

A Single Component, High Efficiency, Rheological Additive for Asphalt Roof Coatings, Adhesives, Sealants, and Mastics

Tixogel® VZ is an organically modified phyllosilicate. When properly activated and dispersed in asphalt cutback, it imparts predictable and consistent viscosity. This is a desirable trait in many asphalt roof coatings, mastics, sealants, and patching compounds. When used in conjunction with traditional fibrous additives, Tixogel® VZ is an ideal substitute for asbestos or attapulgite/surfactant systems.

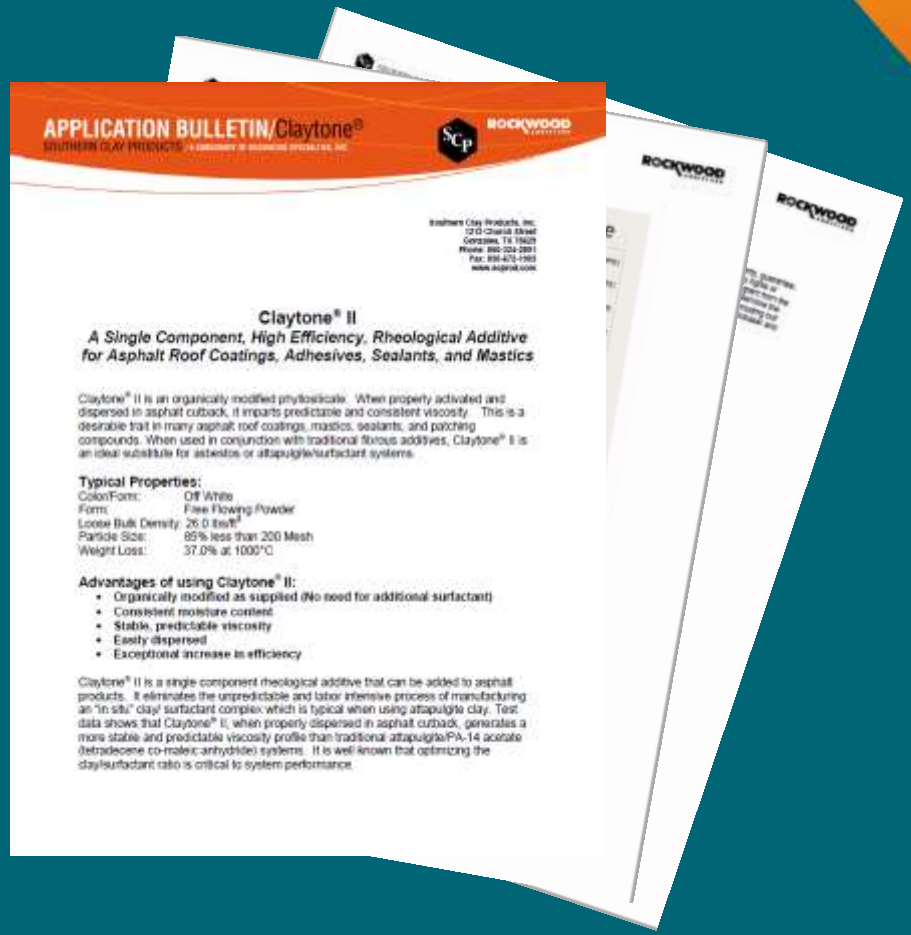
Typical Properties:

Color/Form:	Light Buff Powder
Loose Density:	1.7 g/cm³
Particle Size:	70% less than 200 Mesh
Moisture Content:	3.0% maximum

Advantages of using Tixogel VZ®:

- Organically modified as supplied (No need for additional surfactant)
- Consistent moisture content
- Stable, predictable viscosity
- Easily dispersed
- Exceptional increase in efficiency

Tixogel® VZ is a single component rheological additive that can be added to asphalt products. It eliminates the unpredictable and labor intensive process of manufacturing an "in situ" clay/ surfactant complex which is typical when using attapulgite clay. Test data shows that Tixogel VZ®, when properly dispersed in asphalt cutback, generates a more stable and predictable viscosity profile than traditional attapulgite/PA-14 acetate (tetradecene co-maleic anhydride) systems. It is well known that optimizing the clay/surfactant ratio is critical to system performance.


APPLICATION BULLETIN/Claytone®

SOUTHERN CLAY PRODUCTS

Claytone® II

A Single Component, High Efficiency, Rheological Additive for Asphalt Roof Coatings, Adhesives, Sealants, and Mastics

Claytone® II is an organically modified phyllosilicate. When properly activated and dispersed in asphalt cutback, it imparts predictable and consistent viscosity. This is a desirable trait in many asphalt roof coatings, mastics, sealants, and patching compounds. When used in conjunction with traditional fibrous additives, Claytone® II is an ideal substitute for asbestos or attapulgite/surfactant systems.

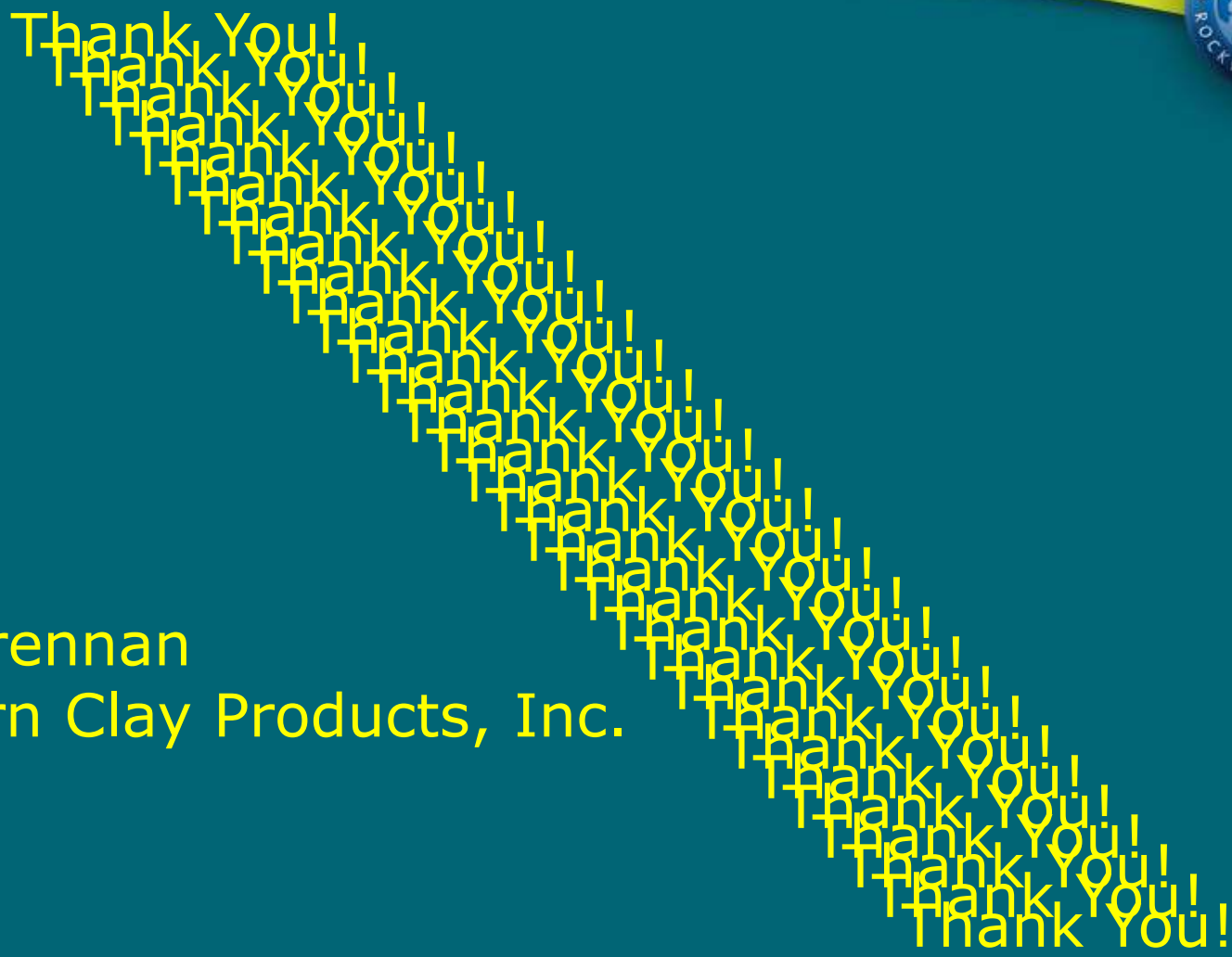
Typical Properties:

Color/Form:	Off White
Form:	Free Flowing Powder
Loose Bulk Density:	26.0 lbs/ft³
Particle Size:	85% less than 200 Mesh
Weight Loss:	37.0% at 1000°C

Advantages of using Claytone® II:

- Organically modified as supplied (No need for additional surfactant)
- Consistent moisture content
- Stable, predictable viscosity
- Easily dispersed
- Exceptional increase in efficiency

Claytone® II is a single component rheological additive that can be added to asphalt products. It eliminates the unpredictable and labor intensive process of manufacturing an "in situ" clay/ surfactant complex which is typical when using attapulgite clay. Test data shows that Claytone® II, when properly dispersed in asphalt cutback, generates a more stable and predictable viscosity profile than traditional attapulgite/PA-14 acetate (tetradecene co-maleic anhydride) systems. It is well known that optimizing the clay/surfactant ratio is critical to system performance.



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