PLAINTIFF'S EXHIBIT
UC-3953

UNION CARBIDE

Calidria ASBESTOS

UNION CARBIDE CORPORATION · METALS DIVISION · P. O. BOX 579 · NIAGARA FALLS, N.Y. 14302 · TEL: 716-278-3376

"CALIDRIA" RG-144 AND RG-244 ASBESTOS IN PVC PLASTISOLS

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1. SUMMARY

PVC plastisols are used as coating materials in pour, dip, and spread applications for the manufacture of synthetic leathers, rainwear, awnings, gaskets, etc. For the processing of plastisols, a structural, thixotropic behavior is required. During application, a nonviscous liquid is desirable which, however, does not run or penetrate too deeply into the substrate afterwards. These processing effects have often been obtained by the addition of pyrogenic silica. In these tests, the effect of "Calidria" RG-144 and RG-244 in PVC plastisols for spread-coating was examined in comparison to that of silica.

50 g. of each of the plastisols, with and without additives, were spread on a piece of fabric. After 30 minutes, the plastisols containing 0.5% "Calidria" exhibited no seep-through, i.e., drip-through. Similar effects with silica were only obtained with concentrations of at least 2% (see Table I).

The flow behavior of the various plastisols is presented in the accompanying graph. As a measure of the structural viscosity, the so-called thixotropic index was obtained by measurement with a Brookfield Viscometer at 3 and 30 rpm.

Plastisol	Thix Index
Without Additive	1
0.5% RG-144	4
0.5% RG-244	4
1.0% Silica	4
2.0% Silica	3

The use of 0.5% RG-144 or RG-244 in plastisols allows the following effects to be obtained:

Pronounced thixotropy

Prevention of seep-through and run-off

Application of the plastisol at greater film thicknesses

Constant and controllable film thicknesses

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1. SUMMARY

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2. INTRODUCTION

As coating materials PVC plastisols are used for pour, dip, and spread processes; the plastisol's viscosity is an important parameter for the various processing techniques. In dip- and pour-coating processes, shear rates of under 1 sec^{-1} are encountered, whereas, for spread coatings values of about 100-1000 sec^{-1} are usual. This means that the viscosity of the plastisol must be chosen in accordance with the shear rates of the various processes.

PVC plastisols with a plasticizer content of 40-55% usually have an undesirably low viscosity. These plastisols are used, among other things, as the base coat on fabrics and nonwovens for the manufacture of synthetic leather, conveyer belts and coverings for water resistance. To increase the low viscosity about 1-3%, thickeners are added. Pyrogenic silica is commonly used for this purpose. Also, large quantities of fillers increase the viscosity but their use as thickeners should be avoided since they worsen the mechanical properties such as tearability, elasticity, flexibility, abrasion resistance, etc. Another way of increasing the viscosity is by adding gelating copolymers. This could, however, shorten the storage stability.

For the processing of plastisols, a thixotropic behavior is desirable.

During application to the substrate, a free-flowing liquid is desirable which, however, does not seep or penetrate too deeply into the fabric. Also it should be possible to apply thicker films with a controllable thickness.

In these tests, the effect of "Calidria" in PVC plastisol for spread coatings was compared to that of silica.

3. EXPERIMENTAL

3.1 Materials

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PVC	50 parts
Plasticizer: DOP	50 "
Stabilizer	
Red Pigment	
Textile - normal fabric for textile coatings	
"Calidria" RG-144 and RG-244	
Pyrogenic Silica	

[redacted]

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3.2 Method

The additives were incorporated into the finished plastisol under a dissolver.

Revolutions: 2800 min^{-1}

Dwell Time: 15 min.

The fabric was stretched over a specially made frame and 50 g. of plastisol, with and without additives, were then spread onto it. Any plastisol which seeped through the fabric dripped into a beaker which was weighed after 30 minutes. The results are presented in Table I.

3.3 "Seep-through" Results

Table I

Amount of plastisol which seeped through the textile in 30 minutes. Quantities in grams.

Without additives: 25 g.

Conc. %	Pyrogenic Silica	"Calidria" 144	244
0.25	22	5	17
0.50	18	0	0
1.00	9	0	0
2.00	0	0	0

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3.4 Flow Behavior Results

The flow behavior of the plastisols is presented in Figure 1 (viscosities measured with a Brookfield viscometer, spindle 4). The plastisol system without additives exhibited Newtonian flow characteristics, i.e., the viscosity is independent of rpm (shear rate); the curve is a straight line parallel to the rpm axis. The curves for the plastisols with additives show that an increase in rpm causes a drop in viscosity, i.e., they exhibit pseudoplasticity. The viscosity differences between the curves for increasing and decreasing revolutions are

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largest at high revolutions and smallest at low revolutions. This means that here the viscosity is not only dependent upon shear rate but also upon time. However, when unagitated after a certain time, the viscosity regains its original value. This reversible, time-dependent phenomenon is thixotropy.

Since no practical measure of thixotropy can be obtained from normal viscosity measurements, the so-called thixotropic index has found its way into literature. This index is only a measure of the gradient of the ascertained viscosity curve.

Thixotropic Index = Viscosity quotient, obtained at two different revolutions.

The following thixotropic indexes were obtained for the plastisols which were examined (at 3 and 30 rpm).

Without additive	~ 1
1% Silica	~ 4
2% Silica	~ 3
0.5% RG-144	~ 4
0.5% RG-244	~ 4

4. ASSESSMENT OF RESULTS

As can be seen from Table I, 0.5% "Calidria" prevented the plastisol from seeping through the fabric. After gelation, the plastisol exhibited no changes in initial coating dimensions (surface area, film thickness). This indicated that as well as preventing seep through, no undesirable running or flowing of the mass occurs, so that the film thickness remains regular and can be controlled.

Seepage through the fabric could not be prevented by using pyrogenic silica. Although, in Table I, 2% silica has a value of 0, i.e., no plastisol dripped through, there was drip formation on the underside of the fabric. Also, a considerable amount of flow occured on the surface of the fabric.

Figure 1 shows that 0.5% "Calidria" and 1% silica have similar viscosities and thixotropic behavior. In spite of this, during the seep through tests, several

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decisive advantages of "Calidria" were observed. This could be due to the different functional mechanisms of "Calidria" and silica. It is common knowledge that with "Calidria" an increase in viscosity is caused due to the formation of a fiber structure, whereas, with silica the structure is composed of agglomerated primary particles.

5. RECOMMENDATIONS

Plastisols can be formulated in many various ways. The results obtained here are thus only valid for the formulation used. However, the following recommendations apply to a large scope of formulations.

When using plastisols for spread coating processes, the addition of RG-144 or 244 is recommended. The following effects are obtainable:

- pronounced thixotropy
- prevention of seep-through
- prevention of flow-off and run marks
- application of thicker films
- constant and controllable film thicknesses

Required "Calidria" concentration: 0.5%
Incorporation via high-speed stirrer
The incorporation is virtually dust-free

To obtain similar effects with silica, a concentration of at least 2% is required. However, this does not produce the desired, low-processing viscosity (see viscosity values for increasing rpm). The incorporation of silica is not dust-free.

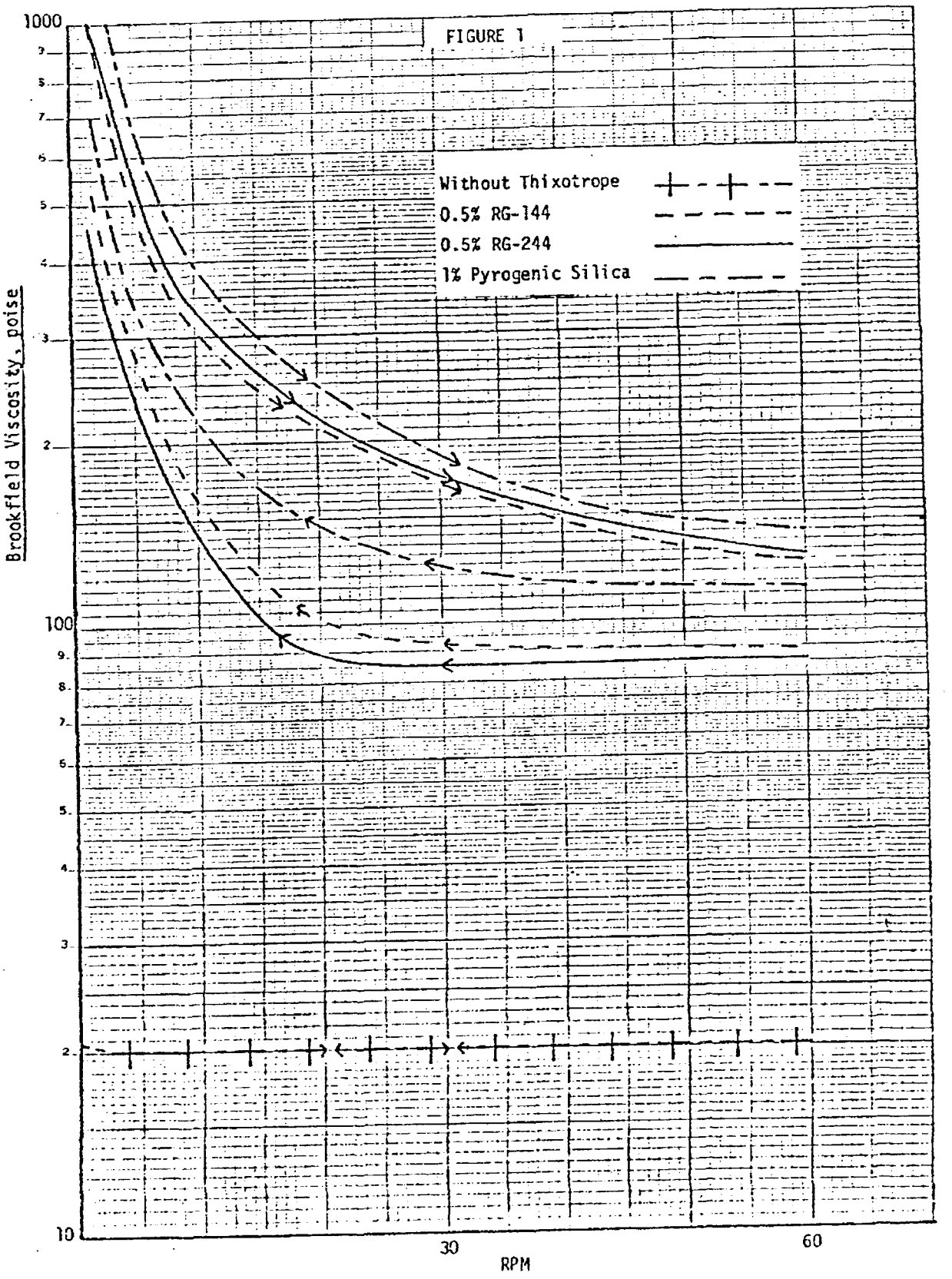
While the tests, results, and recommendations described here, are primarily valid for PVC spread coatings, similar effects are obtainable with PVC plastisols for

- dip coatings
- application of seam sealants
- airless spraying

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CALIDRIA RG-244

HIGH BUILD VINYL MAINTENANCE PAINTS

Calidria RG-244 is a highly effective fibrous thixotrope for the elimination of sag and runoff on vertical and inclined surfaces. Its many advantages include:

ECONOMICAL

Costs less per bag.

Normally use only 1/2 to 3/4 as much as Pyrogenic silica.

EASY TO USE

Wets out quickly.

Easy to disperse.

HANDY TO STORE

Polyethylene overwrap standard - stays dry.

Small bag - less storage space.

SPECIAL ADVANTAGES IN HIGH BUILD VINYL MAINTENANCE PAINTS

High thixotropic efficiency at minimum cost.

Excellent shelf life for long term viscosity and thixotropic properties.

Does not detract from adhesion.

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HIGH-BUILD VINYL MAINTENANCE PAINTS

SUGGESTED FORMULATIONS

	Formula Suggestion VP-3632	Formula Suggestion VP-3634	Formula Suggestion VP-3639	Formula Suggestion VP-3642
	Red Lead Primer	Shipbottom Antifouling	White Anti-corrosive Primer	White Topcoat
CELLOSOLVE	44.45	13.15	36.76	38.20
Methyl Butyl Ketone	6.35	1.88	5.25	5.46
Toluene	6.98	2.07	5.78	6.00
Xylene	4.44	1.32	3.67	3.82
VM&P Naphtha	1.27	0.38	1.05	1.09
BAKELITE Resin VAGH	13.18	--	--	--
BAKELITE Resin VYHH	--	2.49	--	--
BAKELITE Resin VMCA	--	--	21.90	--
BAKELITE Resin VYHD	--	--	--	15.66
Tricresyl Phosphate	1.36	2.27	--	--
Didecyl Phthalate	--	--	3.92	3.90
Calidria RG-244	1.96	1.39	0.92	1.05
Red Lead	20.01	--	--	--
Rosin	--	9.75	--	--
Cuprous Oxide	--	65.30	--	--
Dispersant	--	--	--	0.27
Titanium Dioxide	--	--	11.53	10.95
Clay Extender	--	--	--	13.60
Zinc Phosphate	--	--	9.22	--
TOTAL	100.00	100.00	100.00	100.00

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CALIDRIA RG-244

EPOXY COAL-TAR COATINGS AND ROOFING COMPOUNDS

CALIDRIA RG-244 is a highly efficient fibrous thixotrope for elimination of sag and runoff on vertical and inclined surfaces. Its many advantages include:

BETTER ECONOMICS

Normal use requires only 1/2 to 3/4 as much as pyrogenic silica. RG-244 is three to four times as efficient as the modified clays.

EASE OF HANDLING

Less dusty to handle than conventional gelling agents.

Disperses easier and exhibits fast wet out.

Packaged with polyethylene overwrap - stays dry - convenient for handling and storage.

SPECIAL ADVANTAGES IN EPOXY COAL TAR

High thixotropic efficiency at minimum cost.

Excellent shelf life for long term viscosity and thixotropic properties.

Contributes to good leveling properties for troweling and spray-up applications.

Does not detract from adhesion.

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TYPICAL EPOXY COAL-TAR FORMULATIONS

ROOF COATING

A	Epoxy (ERL-2774)[1]	100 parts
B	Coal Tar	500 parts
	Hardener (ZZL-0814)[2]	25 parts
	CALIDRIA RG-244	5 parts
	Toluene[3]	350 parts

GENERAL PURPOSE "VERTICAL" COATING[4]

A	Epoxy (ERL-2774)	100 parts
B	Coal Tar	139 parts
	Polyamide Resin (ZZLA-0325)[5]	46 parts.
	Magnesium Silicate	123 parts
	Xylene	74 parts
	Ethyl Alcohol (95% denatured)	4 parts
	CALIDRIA RG-244	6 parts
	Catalyst (2, 4, 6 Tri(dimethylamino methyl) phenol)	5 parts

[1] Bisphenol-A type resin available from Union Carbide Corporation.

[2] Minimum irritation potential hardener available from Union Carbide Corporation.

[3] Toluene addition may be varied according to desired flow properties.

[4] Source SSPC-Paint 16-68T, June 1, 1968. Typical uses include tanks, pipes, marine equipment, etc. Exhibits good adhesion to structural steel and concrete surfaces. Good chemical, oil and water resistance.

[5] Available from Union Carbide Corporation.

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CALIDRIA RG-244

ZINC-RICH PRIMERS

Calidria RG-244 is a highly efficient fibrous thixotrope which is unusually effective in preventing zinc dust from settling hard in containers. Its many advantages include:

ECONOMICAL

Normal use requires only 1/4 to 1/3 as much as modified clays and 1/2 to 3/4 as much as pyrogenic silica.

EASY TO USE

Wets out quickly.

HANDY TO STORE

Packaged with polyethylene overwrap - stays dry.

Small bag - less storage space.

SPECIAL ADVANTAGES IN ZINC-RICH PRIMERS

Redisperses quickly.

Excellent shelf life.

High thixotropic efficiency at minimum cost.

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TYPICAL ZINC-RICH PRIMERS

ALKYL SILICATE ZINC-RICH PRIMER		Pounds Per 100 Gallons
A	Cellosolve Silicate X-8018[1]	698
	Trimethylborate[2]	12.5
	Calidria RG-244[1]	12.5
B	Zinc Dust[3]	1132

VINYL ZINC-RICH PRIMER		Pounds Per 100 Gallons
A	Bakelite Vinyl Resin VYHH[1]	109.2
	Methyl n-Butyl Ketone	397.1
	Methyl Ethyl Ketone	137.0
	Calidria RG-244[1]	2.5
	Methanol	3.3
	Red Iron Oxide R-6098[4]	7.9
B	UNION CARBIDE A-1120 Silane	4.1
C	Zinc Dust 222[5]	550

[1]Available from Union Carbide Corporation.

[2]70% Azeotrope of TMB, Ventrol Corporation.

[3]Federated No. 111, New Jersey Zinc or Equivalent.

[4]Pfizer Chemical Company.

[5]New Jersey Zinc Company.

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