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# VANDERBILT

## *Technical Newsletter*

## Typical Properties of Antioxidants and Stabilizers for Adhesive Applications

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Rubber and Plastics Department

## Typical Properties of Antioxidants and Stabilizers for Adhesive Applications

R. T. Vanderbilt Company, Inc.'s Rubber and Plastics Department supplies many raw materials which are used extensively in the adhesives industry. This Technical Newsletter provides general information on some of Vanderbilt's antioxidants and stabilizers that can be used in adhesive applications. Adhesives are expected to withstand many stresses and strains, including heat and long-term storage. The antioxidants and antioxidant synergists supplied by Vanderbilt will greatly improve the heat and oxidative resistance of these compounds, which in turn will help with the retention of original physical properties. The additives listed below can help to limit, if not eliminate, the damaging effects of these stresses on the performance of the adhesives.

### Antioxidant Synergists

#### **VANOX<sup>®</sup> MTI** antioxidant 2-mercaptotoluimidazole

Properties	VANOX MTI
Physical Form	powder
Color	light pink to light tan powder
Density, Mg/m <sup>3</sup>	1.33
Melting Point, Initial, °C*	250 min.
Assay, %*	97 min.
Heat Loss, 2 hrs @ 100-105°C, %*	1.0 max.
Fineness through 100 mesh, %*	99.9 min.
Ash, %*	0.5 max.
Solubility	Moderately soluble in acetone and alcohol. Insoluble in water.

\* Certified Property

*General Recommendations:* The aged properties of an adhesive compound are considerably improved by using **VANOX MTI** as an antioxidant synergist with either an amine or phenolic antioxidant. This product is nonstaining, nondiscoloring, and normally does not interfere with the surface tack of latex compounds.

## VANOX SPL Slurry

Zinc 2-mercaptotoluimidazole with phenolic antioxidant in an aqueous slurry

Properties	VANOX SPL Slurry
Physical Form	liquid
Color	white
Density, Mg/m <sup>3</sup>	1.18
pH*	8.0 – 10.0
Total Solids 3 hrs @ 80-85°C, %*	50.0 min.

\* Certified Property

*General Recommendations:* **VANOX SPL Slurry** is a complete antioxidant system that improves the heat resistance and aging properties of natural and synthetic latexes. It also helps to improve the whiteness and brightness of colored latex compounds.

## VANOX ZMTI antioxidant

Zinc 2-mercaptotoluimidazole

Properties	Powder	Slurry
Physical Form	powder	liquid
Color	white to light tan powder	white liquid
Density, Mg/m <sup>3</sup>	1.54	1.25
Melting Point Initial, °C	300 min.	---
Heat Loss 2 hrs @ 60-65°C, %*	2.0 max.	---
Fineness, through 200 mesh, %*	99.9 min.	---
Zinc Content, %*	17.2 – 19.3	8.75 min.
pH, neat sample	---	7.0 – 9.0
Total Solids 2 hrs @ 100-105°C, %*	---	52.2% min.
Solubility	Soluble in ethanol and methanol. Practically insoluble in other organic solvents and water.	Soluble in water.

\* Certified Property

*General Recommendations:* **VANOX ZMTI** is a well-known antioxidant synergist in elastomers and thermoplastic rubbers. This product is especially effective in adhesives used in high temperature applications, whether intermittently or consistently, and its virtually unapproachable melting point indicates outstanding permanence in high performance hot melts. For water-based systems, this product is also available in a convenient 50% active slurry.

## Amine Antioxidants

### **AGERITE® STALITE® and AGERITE STALITE S** antioxidants

Mixtures of octylated diphenylamines

<b>Properties</b>	<b>AGERITE STALITE</b>	<b>AGERITE STALITE S</b>
Physical Form	liquid	powder
Color	amber	light gray-green to light tan
Density, Mg/m <sup>3</sup>	0.995	1.02
Set Point, °C*	---	90-99
Heat Loss 2 hrs @ 65°C, %*	0.25	0.5 max.
Fineness retained on 16 mesh, %*	---	0.2 max.
Ash, %*	---	0.5 max.
Hexane Insolubles, %*	0.1 max.	---
Solubility	Practically insoluble in water. Very soluble in alcohol, toluene, and carbon disulfide.	

\* Certified Property

*General Recommendations:* **AGERITE STALITE** and **AGERITE STALITE S** are strong amine-type antioxidants for elastomeric solutions and latex adhesives. These products are sufficiently nonstaining and nondiscoloring for most applications. They are very effective viscosity controllers in low temperature EVA hot melts, but are not recommended for hot melt temperatures above 175°C (347°F).

### **AGERITE SUPERFLEX®** antioxidant

Diphenylamine-acetone reaction product

<b>Properties</b>	<b>AGERITE SUPERFLEX</b>
Physical Form	liquid
Color	dark brown
Acetone Insolubles, %*	0.10 max.
Density at 25°C, Mg/m <sup>3</sup>	1.09
Brookfield Viscosity, poise	50 max.
Moisture, %*	0.5 max.
Low Molecular Weight, %*	26 max.
Low and Medium Molecular Weight, %*	45 min.
Solubility	Very soluble in acetone, toluene, chloroform, and carbon disulfide. Insoluble in water.

\* Certified Property

*General Recommendations:* **AGERITE SUPERFLEX** provides good, low cost protection against aging in most adhesives, mastics and caulks, where discoloration and staining are not of concern. It also affords outstanding protection at elevated temperatures when used in conjunction with **VANOX ZMTI** or **VANOX MTI**.

## Phenolic Antioxidants

### **VANOX GT** antioxidant

Tris-(3,5-di-t-butyl-4-hydroxybenzyl) isocyanurate

<b>Properties</b>	<b>VANOX GT Powder</b>
Physical Form	crystalline powder
Color	white
Density, Mg/m <sup>3</sup>	1.00
Melting Range, °C	218 min.
Color of Solution @ 425 nm, %*	95.0 min.
500 nm, %*	97.0 min.
Volatiles 2 hrs @ 105°C, %*	0.2 max.
Solubility	Very soluble in acetone, chloroform, and dimethylformaldehyde. Moderately soluble in toluene. Slightly soluble in methanol, hexane, and petroleum ether. Insoluble in water.

\* Certified Property

*General Recommendations:* **VANOX GT** is a very high melting point, trifunctional hindered phenol that is frequently used in combination with a phosphite antioxidant in high temperature hot melts. The combination of hindered phenol and phosphite is recognized as an excellent stabilizer system for black polymer hot melts. **VANOX GT** is nonstaining and nondiscoloring when used alone.

### **VANOX L** antioxidant

Reaction product of p-cresol and cyclopentadiene

<b>Properties</b>	<b>VANOX L Powder</b>
Physical Form	powder
Color	white to cream
Density, Mg/m <sup>3</sup>	1.135
Melting Point Onset, °C*	105 min.
Volatiles 2 hrs @ 100°C, %*	1.0 max.
Ash, %*	0.1 max.
Solubility	Soluble in acetone and toluene. Insoluble in water.

\* Certified Property

*General Recommendations:* **VANOX L** provides excellent antioxidant protection without discoloration and staining. This product has a high melting point and provides excellent viscosity and color stabilization in most adhesive applications.

## VANOX MBPC antioxidant

2,2'-methylene-bis-(4-methyl-6-t-butylphenol)

Properties	VANOX MBPC
Physical Form	powder
Color	white to cream
Ash Content, %*	0.1 max.
Sieve Residue, 63mm, %*	1.5 max.
Melting Range, °C*	125 min.
Volatile Matter, 2 hrs. @ 100°C, %*	0.3 max.
Density at 25°C, Mg/m <sup>3</sup>	1.08
Solubility	Soluble in acetone, chloroform and toluene. Moderately soluble in alcohol. Insoluble in water.

\* Certified Property

*General Recommendations:* **VANOX MBPC** provides superior antioxidant protection in a wide range of light colored solution and latex adhesives. This product is especially effective in NR, CR, SBR, NBR, and IR.

## VANOX 1290 antioxidant

2,2'-ethylidene bis (4,6-di-t-butylphenol)

Properties	VANOX 1290 Powder
Physical Form	powder
Color	white
Color APHA, 25% in acetone*	50 max.
Density, Mg/m <sup>3</sup>	1.01 ± 0.03
Melting Range, °C*	162 – 166
Purity, %*	99 min.
Solubility	Soluble in acetone and toluene. Moderately soluble in alcohol, hexane, and gasoline. Insoluble in water.

\* Certified Property

*General Recommendations:* **VANOX 1290** is a nonstaining, nondiscoloring, high melting point stabilizer for hot melt adhesives. It also helps to protect against thermal degradation of most polymers and resins.

## AGERITE SUPERLITE<sup>®</sup> antioxidant

Mixture of polybutylated bisphenol A

Properties	AGERITE SUPERLITE
Physical Form	liquid
Color	amber
Gardner color*	5 max.
Density, Mg/m <sup>3</sup>	0.955
Brookfield Viscosity, cps*	4,000 – 10,000
Refractive Index @ 25°C*	1.5220 -1.5240
Ash, %	0.5 max.
Solubility	Very soluble in toluene, chloroform, and gasoline. Practically in soluble in water.

\* Certified Property

*General Recommendations:* **AGERITE SUPERLITE** is a nonstaining, nondiscoloring general-purpose antioxidant for light colored elastomeric solutions and latexes. This product is also recommended for most caulks, sealants, and mastics that are subject to weathering.

## Dithiocarbamate Antioxidants

### **BUTYL ZIMATE<sup>®</sup> Powder and Slurry**

Zinc di-n-butyl dithiocarbamate

<b>Properties</b>	<b>Powder</b>	<b>Slurry</b>
Physical Form	powder	liquid
Color	white to cream	white
Density, Mg/m <sup>3</sup>	1.21	1.10
Fineness through 100 mesh, %*	99.9 min.	---
Heat Loss 2 hrs @ 60-65°C, %*	0.5 max	---
Melting Range, °C*	103 – 110	---
Zinc Content*	13.0 – 15.0	---
Assay*	---	50.0
pH, neat sample*	---	9.0 – 11.5
Total Solids 2 hrs @ 80-85°C, %*	---	53 min.
Solubility	Powder is soluble in chloroform, gasoline, and toluene. Powder is insoluble in water.	

\* Certified Property

*General Recommendations:* **BUTYL ZIMATE** is a workhorse hot melt stabilizer. It helps to retard oxidation, skinning, and variations in color and viscosity in a wide range of uncured polymers and resins. **BUTYL ZIMATE** can be used in adhesive applications where one general-purpose accelerator is prescribed, but it works especially well as a component in special purpose hot melt antioxidant systems. For water-based systems, this product is also available in a convenient 50% active slurry.

## Quinoline Antioxidants

### **AGERITE RESIN D<sup>®</sup> antioxidant**

Polymerized 1,2-dihydro-2,2,4-trimethylquinoline

<b>Properties</b>	<b>Pastilles</b>	<b>Powder</b>
Physical Form	pastilles	powder
Color	amber	amber
Density, Mg/m <sup>3</sup>	1.06	1.06
Softening Point, °C (B&R)*	82 - 102	82 - 102
Heating Loss, %*	1.0 max.	1.0 max.
Fineness (on 100 mesh), %*	---	1.0 max.
Ash, %*	0.25 max.	0.25 max.
Solubility	Very soluble in acetone, toluene, chloroform, and carbon disulfide. Slightly soluble in petroleum hydrocarbons. Practically insoluble in water.	

\* Certified Property

*General Recommendations:* **AGERITE RESIN D** is a nonblooming, general-purpose antioxidant for SBR and NBR solution adhesives. This product works especially well in industrial lamination operations that combine coating and calendaring.

## AGERITE MA antioxidant

Polymerized 1,2-dihydro-2,2,4-trimethyl quinoline

Properties	Pastilles	Powder
Physical Form	pastille	powder
Color	amber	cream to light amber
Ash Content, %*	0.25 max.	0.25 max.
Fineness retained on		
100 mesh, %*	---	0.0 max.
200 mesh, %*	---	5.0 max.
Heat Loss, %*	1.0 max.	1.0 max.
Softening Point, °C*	115-135	115-135
Density at 25°C, Mg/m <sup>3</sup>	1.06	1.06
Solubility	Very soluble in acetone, benzene, chloroform, and carbon disulfide. Slightly soluble in hydrocarbons. Practically insoluble in water.	

\* Certified Property

*General Recommendations:* **AGERITE MA** is a version of **AGERITE RESIN D** with a higher melting point that provides excellent protection to polymers subject to extreme heat conditions. This makes it superior in most hot melt and other high heat adhesive applications. It also provides excellent aging protection to crosslinked polyethylene.

“Certified Property” indicates a property certified on the product’s Certificate of Analysis.

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