

Key Performance Advantages

- Improves pigment dispersion and film integrity
- Excellent wetter
- Maximizes tinting strength and dispersion



Paints and Coatings

FLEXITANE[®] CA 6000

Performance-Enhancing Specialty Coating Additive

FLEXITANE[®] CA 6000 is a versatile performance-enhancing specialty coating additive. It can be an effective solution to addressing formulation requirements, while often reducing the need for higher levels of special additives in the system. When FLEXITANE CA 6000 is used in solvent-based industrial coating systems, a combination of benefits is obtained during production and in the finished formulations which includes:

- Enhanced pigment dispersion through displacement of monomolecular moisture
- Improved film integrity due to superior substrate wetting
- Improved cure times and film performance
- Enhanced electrostatic-spray application

Selected Formulating Properties

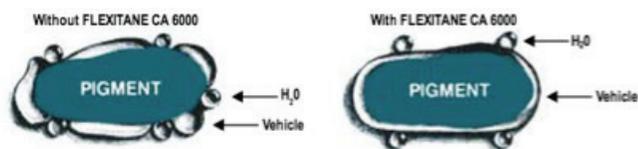
The following are selected formulating properties of FLEXITANE CA 6000. They are not to be considered product specifications.

Distillation Range @ 760 mmHg (90%min.)°C	112-133
Vapor Pressure @ 20°C, mmHg	~11
Density of Vapors (air=1) (calcd.)	2.6-3.0
Specific Gravity @ 20/20°C	~1.02
Weight per U.S. Gallon @ 20°C, lb	~8.5
Coefficient of Expansion per°C	0.001
Flash Point, Tag Closed Cup, °C/F	34/94
Evaporation Rate, by Volume (n-butylacetate=100)	101
Solubility in Water @ 20°C, % by Weight	2.6
Solubility Parameter, δ	10.8
Hydrogen Bonding Parameter, γ	2.5

Displaces Monomolecular Moisture

Wetting is important in practically all coating formulations. FLEXITANE CA 6000 has a powerful affinity for hydrophilic surfaces, which include many metals and most commonly used pigments. Normally, there is a monomolecular film of water strongly adsorbed on these surfaces and this film must be displaced before the surface can be wetted by a solvent, vehicle, or coating. The strong affinity of the hydrophilic surface for this water layer makes such displacement difficult, particularly for resin systems, and creates a whole series of problems from the initial pigment dispersion to film durability. These problems have long been recognized, and quite often special additives have been used to overcome these difficulties. However, most of the surface-active additives will remain in the dried film and weaken the dried film's performance.

Moisture Displacement



FLEXITANE CA 6000 is an excellent wetter. It will displace the monomolecular film of water on a pigment surface because it has a higher energy of adsorption [604 ergs/cm²] than does water. No other additive has energy of adsorption of sufficient magnitude to displace water from pigment particles. This benefit is also important in aluminum pigment-based systems, where elimination of moisture from the pigment surface will aid in lowering gassing tendencies associated with this type of pigmentation.

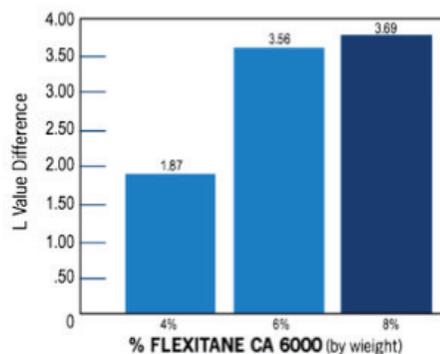
FLEXITANE CA 6000 should be incorporated in the pigment dispersion process during coating manufacture. When used in this manner, it will displace water from the pigment surface to allow the resin to wet the pigment more thoroughly and quickly. This will reduce the time and energy required to disperse the pigment agglomerates to a finer size, which can result in significantly lower manufacturing costs. This is best documented in the pigment dispersion concentrate below.

Color Pigment Concentrate

Materials	Weight	
	0% FLEXITANE CA 6000	8% FLEXITANE CA 6000*
High-Solids Resin	81.97	81.97
Phthalocyanine Blue	7.45	7.45
Toluene	10.58	9.73
FLEXITANE CA 6000	-	0.85
Total Nonvolatile By Weight	72.08	72.03
Grind (µm) @ 1 hr.	85	85
4 hr.	30	<5
8 hr.	<5	-

*Based on total weight of solvents

Improved Color Development



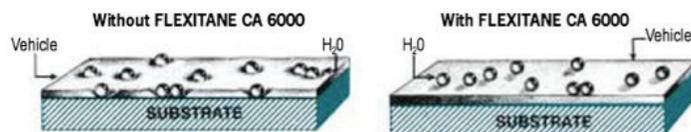
Maximizing tinting strength/dispersion is a point of particular value when expensive pigments are used or when batch-to-batch reproducibility is needed for quality issues. Several carbon black tinting formulations were made with and without FLEXITANE CA 6000 in the dispersion phase. An equal weight of each black tinting formula was added to equivalent white high-solids coatings. As evidenced by the improved tint strength values in the graph above, the systems containing FLEXITANE CA 6000 Performance-Enhancing Specialty Coating Additive provide improved tinting strength over the control system, because of the improved dispersion of the carbon black.

Improved Film Integrity Through Superior Substrate-Wetting

As with pigment surfaces, a monomolecular film of water is usually present on the surface of substrates that will be covered by the protective coating.

In comparison to coatings without FLEXITANE CA 6000, coatings with FLEXITANE CA 6000 will displace this moisture from the substrate and will allow the surface to be wetted more readily by the coating. As a result, film integrity will be improved.

Provides Improved Substrate Wetting



Film integrity improvements with FLEXITANE CA 6000 have been noted with a number of different polymers in a broad variety of coating applications. The epoxy-polyamide example formulations demonstrate the use of FLEXITANE CA 6000. Note that for optimal stability in an epoxy-polyamide coating, the FLEXITANE CA 6000 is added to the epoxy portion only.

Epoxy-Polyamide Topcoat

Component A		Weight	
Materials	0% FLEXITANE CA 6000	12% FLEXITANE CA 6000*	
Epoxy Resin	278.6	278.6	
Thickener	5.0	5.0	
Titanium Dioxide	50.5	50.5	
Extender Pigment	250.0	250.0	
Phthalocyanine Blue	0.1	0.1	
Xylene	73.5	52.0	
FLEXITANE CA 6000	-	21.5	

*Based on total solvent in component A & B and incorporated into A only

Component B	
Materials	Weight
Polyamide Resin	207.5
Thickener	8.0
Black Iron Oxide Pigment	4.5
Red Iron Oxide Pigment	0.8
Silica (Modified)	100.0
Calcined Clay	80.0
Xylene	82.5
Diacetone Alcohol	23.5

Blend ratio of 59.5% Component A and 40.5% Component B (by Wt.)

As demonstrated in the following electron micrographs, the coating containing the FLEXITANE™ CA 6000 effectively displaces monomolecular moisture, resulting in reduction of pinholes and craters. The coating containing FLEXITANE CA 6000 provides superior film integrity compared to the control system.

Without FLEXITANE CA 6000



With FLEXITANE CA 6000



Improves Cure Time

Cure time is an important criterion in high performance coatings. Where less time is required for drying a coating, the following benefits will occur:

- Lower energy costs
- Increased line speeds
- Reduced lay-up time before handling or recoat

FLEXITANE CA 6000 promotes a more rapid dry in several ways. First, FLEXITANE CA 6000 prevents surface skinning. This improves through-drying of the film. Second, FLEXITANE CA 6000 forms azeotropes with numerous solvents used in the formulation, which facilitates solvent release from drying films. For comparison, the following example entitled Isocyanate Topcoat demonstrates the use of FLEXITANE CA 6000 in a typical high-performance coating application.

Isocyanate Topcoat

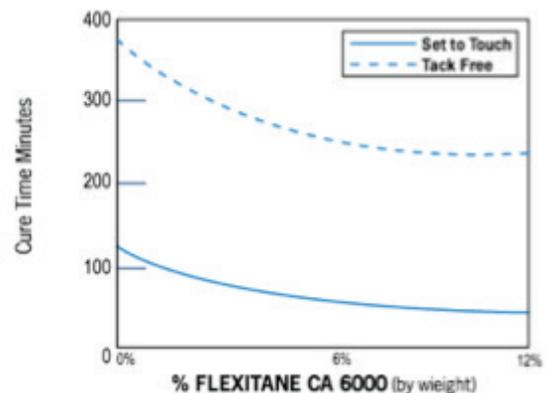
Part A		Weight % FLEXITANE CA 6000	
Materials	0%	6%*	12%*
Polyester Resin	185.93	185.93	185.93
Polyester Resin	123.95	123.95	123.95
Titanium Dioxide	198.32	198.32	198.32
Leveling Agent	19.87	19.87	19.87
Catalyst	1.99	1.99	1.99
Defoamer	0.02	0.02	0.02
MEK	101.7	95.60	89.50
Xylene	25.40	23.88	22.35
PM Acetate	101.70	95.60	89.50
Butyl Acetate	25.40	23.88	22.35
FLEXITANE CA 6000	-	15.24	30.50
Total	784.28	784.28	784.28

Part B	
Materials	Weight
Isocyanate Resin	210.21

*Based on the total solvent weight in Part A

The following graph demonstrates the reduced cure time of the isocyanate topcoat formulation containing FLEXITANE CA 6000.

Improved Cure Time



Coatings that contain FLEXITANE CA 6000 will dry quickly. This benefit provides for additional advantages. First, coatings such as primers containing FLEXITANE CA 6000 that cure sooner may be recoated with less lay-up time. Second, coatings with FLEXITANE CA 6000 will develop earlier chemical and water resistance, and are less likely to suffer early damage. The final result is that cure times and film performance are improved.

FLEXITANE CA 6000 Is a Polar Additive with Low Resistivity

Electrostatic spraying is a method of applying coatings which greatly enhances application efficiency. The spraying efficiency of properly formulated electrostatic coatings can approach very high transfer efficiency levels. However, the solvents used in most coating formulations are of such low polarity that they generally create an electrical resistance in the system that is too high, which then subsequently limits the spray application in achieving its maximum efficiency.

FLEXITANE CA 6000 is polar and, therefore, is electrically conductive. Because of its high dielectric constant (25.2), FLEXITANE CA 6000 is appropriate for use in coatings which are to be electrostatically applied. Substances of high dielectric constant are good ionizing media. Translated into practical terms, this means that FLEXITANE CA 6000, with its low resistivity, is very efficient in improving the electrical conductivity of coatings for electrostatic applications.

The proper incorporation of FLEXITANE CA 6000 in coatings intended for electrostatic application results in greater coverage, more uniform coating application, and better spray break-up as compared to coatings without FLEXITANE CA 6000. These improvements occur because, with FLEXITANE CA 6000 the electrical charge per weight of paint is increased, paint droplets are more strongly attracted to objects being sprayed and better paint "wrap-around" will take place. The end result is improved transfer efficiency and increased equipment capacity.

For comparison, application properties shown in table below illustrate the benefits of incorporating FLEXITANE CA 6000 in an electrostatically applied coating. It is clear that the FLEXITANE CA 6000 Performance-Enhancing Specialty Coating Additive promotes efficiency in coverage by assuring each individual coating particle has the necessary electrical charge, which results in the dramatic improvement in coverage (wrap), flow and increased equipment capacity.

Thermoset Acrylic-Based Coating Properties

Band Width	Cm	Flow Rate	mL/min	Viscosity-Brookfield	cps
Control	19.05	Control	82	Control	45
FLEXITANE CA 6000	26.04	FLEXITANE CA 6000	92	FLEXITANE CA 6000	45

Formulation Considerations

The quantities of FLEXITANE CA 6000 (as a portion of the total solvent) which are required to maximize its benefits will vary from one system to another, and are of course dependent on the specific resin, solvents, and pigments that comprise the coating. A general recommended starting point to fully receive the benefits of FLEXITANE CA 6000 is in the range of 8-12% replacement of the total solvent system. A level within the recommended range has been proven to provide substantial performance improvements to high-performance solvent-based coating systems.

Product Stewardship

ANGUS encourages its customers to review their applications of ANGUS products from the standpoint of human health and environmental quality. To help ensure that ANGUS products are not used in ways for which they are not intended, ANGUS personnel will assist customers in dealing with environmental and product safety considerations. For assistance, safety data sheets or other information, please contact your local ANGUS representative at the numbers provided in this document. When considering the use of any ANGUS product in a particular application, review the latest Safety Data Sheet to ensure that the intended use is within the scope of approved uses and can be accomplished safely. Before handling any of the products, obtain available product safety information including the Safety Data Sheet(s) and take the necessary steps to ensure safety of use.

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