

AEROSOL® WA-300 Surfactant

Wetting Agent for Pressure-Sensitive Adhesives

Introduction

AEROSOL WA-300 Surfactant is a formulated product that finds use as a post-addition wetting agent for pressure-sensitive adhesives (PSA). During the manufacture of PSAs, it is critical that the surface tension of the polymer emulsion be lowered. This facilitates its wetting-out onto the film substrate ensuring a high quality product. AEROSOL WA-300 imparts excellent wetting characteristics to PSA emulsions, significantly reducing both static and dynamic surface tension. The product minimizes changes in PSA viscosity and facilitates fast line-speeds. PSA products that use AEROSOL WA-300 are functional on a variety of surfaces and demonstrate improved coater stability, improved shear/peel ratio, enhanced operational efficiency and increased production output.

Features and Benefits

The features and benefits of AEROSOL WA-300 Surfactant as a post-addition wetting agent for PSA products are as follows:

Features	Benefits
Enhances wetting of formulated PSA onto substrate	Improves peel and shear performance of PSA
Liquid product, formulated for PSA application	Dissolves easily and quickly into application solution
High flash point of 114°C (237°F)	Low volatility, safe to handle and environmentally friendly
Functional at low concentrations	Economical
Low foaming	Minimal impact on process
Food contact approvals	Suitable for food applications
Minimal impact on adhesive viscosity, grit and coagulum	Broader operational window, lower maintenance and less down time
Low viscosity of adhesive at low shear rate	Improved coating and enhance product aesthetics
Ability to run at high line speed	Increased productivity

Physical and Chemical Properties

AEROSOL WA-300 Surfactant is a proprietary product. Select chemical and physical properties of the product are as follows:

Type	Anionic/Non-ionic
Appearance:	Clear liquid
Solids, % by weight	72-77
Solvent	Water and Propylene glycol
Color, APHA, max.	100
Specific gravity @ 25°C	1.08-1.1
Viscosity, cps @ 25°C	200-400
Flash Point, °C	>114
Solubility in organic solvents	good
Solubility in water (1 to 5% solution)	Clear to hazy liquid

Technology

A. Pressure Sensitive Adhesives

A pressure sensitive adhesive (PSA) laminate represents a complex, multi-component product (Figure 1) comprising a minimum of four elements: a release liner, release coating, adhesive and facstock. Each component plays a critical role in the performance of the product. The laminates are produced by a series of operations that combine the various layers of material into a finished product. Figure 2 illustrates a simple PSA manufacturing process. The two prevalent technologies for PSA laminate manufacture include calendaring or co-extrusion of polymers.

Market segments in which PSA products find application include the aviation, automotive and other transportation industries, food & beverage, health & beauty, chemical, consumer, pharmaceutical and health care industries. Postage stamps, tapes, clear bottle, container, packaging and address labels, medical bandages and pharmaceutical patches all represent different types of pressure sensitive adhesive laminates.

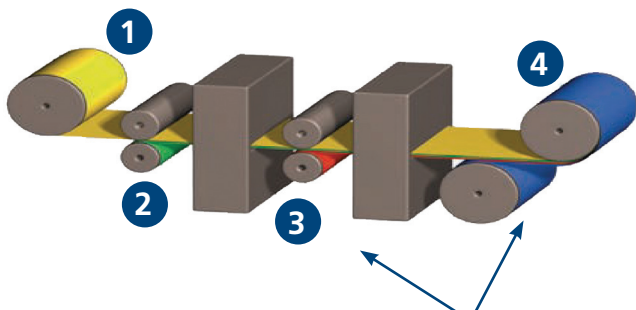
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Figure 1 – Pressure Sensitive Laminate Construction (Four Elements)



A surfactant wetting agent can be added to either the adhesive (3) or facestock (4) layers. The AEROSOL WA-300 is incorporated into the tanks which contain the adhesive and facestock products which are fed to the roller coaters.

Figure 2 PSA Manufacturing Process – Wetting Agent Application via Roller Coaters



AEROSOL WA-300 Surfactant Addition Points – Incorporate into polymer emulsion tanks that feed roller coaters 3 and 4.

B. Wetting Agents for Pressure Sensitive Adhesives

During the manufacture of the multi-component PSA laminate, it is important that the layers come together uniformly and adhere to each other. Since the surface energies of the various components may differ greatly, it is important that the layers wet-out properly. A common approach for insuring adequate wetting and adherence is the use of wetting agents. Typically these are based on either dioctyl sulfosuccinate (i.e. DOSS, AEROSOL[®] OT) or acetylene diol chemistries (i.e. AD-1, conventional acetylenic diol and AD-4, a proprietary acetylenic diol product).

Wetting agents are typically incorporated into the PSA manufacturing process at a post-addition stage. When added at a concentration of approximately 1% to the adhesive or facestock emulsions, the wetting agent lowers the surface tension of the emulsion, allowing it to wet-out easily onto the substrate.

PSA products are typically stuck onto glass, polymers, paper or metallic foil. In each case, the surface energy characteristics of the adhesive emulsion and substrate may vary significantly. The incorporation of the wetting agent into the adhesive emulsion leads to further benefits when this layer is applied to the final package substrate. The wetting agent in the adhesive layer assists in wetting out the adhesive onto the substrate, increasing overall compatibility and improving packaging aesthetics.

C. AEROSOL WA-300 Surfactant as a Post-Addition Wetting Agent

AEROSOL WA-300 Surfactant has been specifically formulated as a wetting agent for coater ready PSA applications. The product offers performance, handling and safety advantages over conventional DOSS and acetylene diol (i.e. AD-1 and AD-4) based wetting agent products.

(1) Wetting Agents and Impact on Surface Tension

Table 1 details the outstanding performance of the AEROSOL WA-300 Surfactant wetting agent.

Table 1 Equilibrium Surface Tensions

Surfactant	Surface Tension (mN/m)
Water	71.6
0.5% AEROSOL WA-300	24.4
0.5% Dioctyl sulfosuccinate (DOSS)	24.8
0.5% AD-1	31.0
0.5% AD-4	26.0

Figures 3 and 4 illustrate the outstanding performance of this product over a range of concentrations in lowering the dynamic surface tensions of adhesive emulsions at different bubbles/second rates. This data indicates that it is possible to achieve highly efficient wetting performance with AEROSOL WA-300 at low concentration.

Figure 3

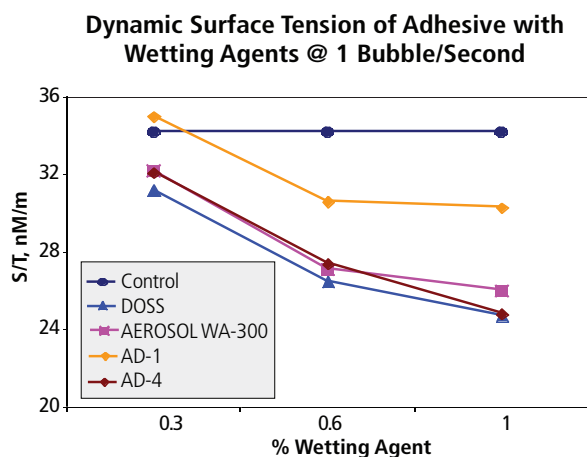
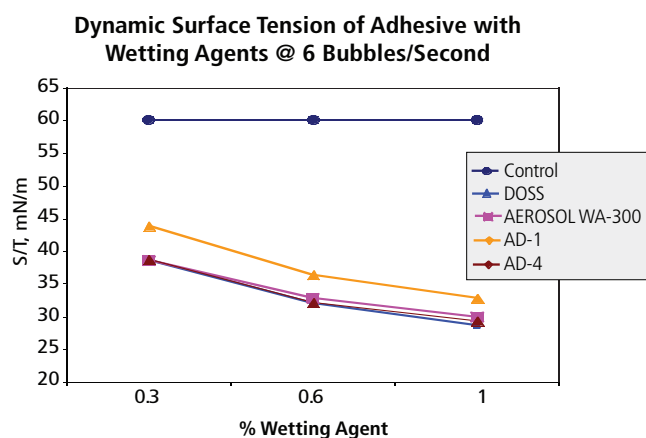


Figure 4



(2) Effect of Wetting Agent on Contact Angle on LSES (Low Surface Energy Substrates)

AEROSOL WA-300 is effective in reducing the contact angle of the PSA adhesive on low surface energy substrates. The product is highly functional on polyolefin, polyester and release paper substrates.

Table 2 Contact Angle of Adhesive with 1% Wetting Agent

	Glass	Steel	Release Paper	HDPE	Polyester	Polypropylene
Control	57.3	75.1	73.5	59.0	65.2	65.3
AEROSOL WA-300	48.4	50.8	51.3	41.1	45.6	50.0
DOSS	45.5	42.3	56.2	54.6	60.3	52.0
AD-1	61.2	52.9	73.7	57.7	55.5	58.6

(3) Wetting Agents and Foaming

Table 3 compares the foaming properties of 1% aqueous solutions of the AEROSOL WA-300 Surfactant, DOSS and AD-4 surfactants. AEROSOL WA-300 Surfactant shows faster foam dissipation than DOSS and is equivalent to AD-4 surfactant. Thus, AEROSOL WA-300 will effectively wet-out the adhesive emulsion product but not adversely affect production by producing high amounts of foam.

Table 3 Foaming Properties of Wetting Agents

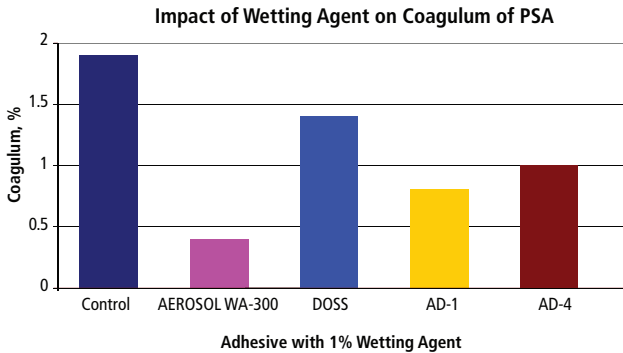
	Foam Volume (mls)	Time to Zero Foam (seconds)
1% DOSS	310	572
1% AD-4	310	422
1% AEROSOL WA-300	300	400

(4) Effect of Wetting Agents on Adhesive Mechanical Stability

PSA emulsions containing various wetting agents were subjected to a mechanical shear at 1400 rpm for 15 minutes and then measured for coagulum generation. AEROSOL WA-300 yielded the lowest coagulum indicating excellent adhesive stability. Additionally, low coagulum generation leads to improved overall productivity as maintenance requirements are reduced and overall operational efficiency enhanced. PSA film aesthetics are also positively impacted by low coagulum.

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Figure 5 - Mechanical Stability of PSA Emulsions Containing Wetting Agents

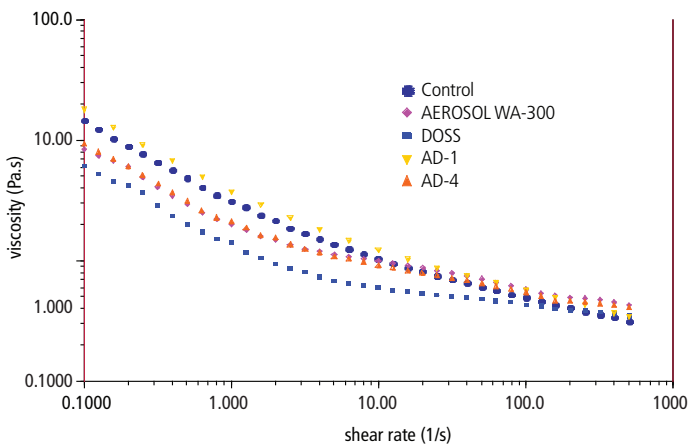


(5) Effect of Wetting Agents on PSA Rheology (Viscosity at Differing Shear Rates)

PSA emulsion adhesives (Figure 6) containing the various wetting agents were subjected to a shear stress and the viscosity of the adhesives monitored. PSA emulsions containing AEROSOL WA-300 are less prone to viscosity changes and thus exhibit a broader operational window. Thus AEROSOL WA-300 gives the end customer greater flexibility with respect to his processing parameters.

Additionally, AEROSOL WA-300 leads to excellent roller pick-up and a better overall coating. Product leveling and film forming properties are enhanced and thus one achieves an adhesive with improved aesthetics and better appearance.

Figure 6 – PSA Rheology - Impact of Wetting Agent on Adhesive Viscosity at Differing Shear Rates



(6) Effect of Wetting Agents on PSA Line Speed

AEROSOL WA-300 Surfactant has demonstrated a 2 – 3 times improvement in PSA line speeds. Operating rates of 600 – 900 ft/min. are achievable, and thus AEROSOL WA-300 offers increased productivity.

(7) Effect of Wetting Agents on Adhesive Properties

Table 4 illustrates the effectiveness of AEROSOL WA-300 Surfactant in wetting out a PSA adhesive onto a steel substrate. This enhanced wetting leads to improvements in the peel and shear performance of the adhesive.

Table 4 Wetting of Contact PVC/Adhesive onto Steel Substrate and Impact on Peel and Shear Properties

Wetting Agent	Shear (Hours to failure)	Peel (N/cm)
Control	0.25	1.8
AEROSOL WA-300	46	9.0
DOSS	25	12.0
AD-4	7	8.5

(8) Wetting Agents and Water Whitening Resistance

PSA emulsions containing the various wetting agents were subjected to water whitening resistance tests. This involved placing the films in water at room temperature (25°C) and elevated temperatures (100°C) and then assessing them for appearance. AEROSOL WA-300 surfactant performed similarly to DOSS and acetylene diol (i.e. AD-1 and AD-4) products.

Table 5 Water Whitening Resistance of PSA Emulsions with 1% Wetting Agents

Wetting Agent	Film Appearance Following Water Immersion @ 25°C	Film Appearance Following Water Immersion @ 100°C
Control	Clear to slightly hazy	Hazy
AEROSOL WA-300	Clear to hazy	Hazy
DOSS	Clear to hazy	Hazy
AD-4	Clear to hazy	Hazy
AD-1	Hazy	Very hazy

Markets and Recommendations

Manufacturers of PSA products are encouraged to evaluate AEROSOL WA-300 for their specific products. AEROSOL WA-300 Surfactant should be incorporated at a 0.3 to 1.0% concentration based upon the weight of the polymer emulsion.

Technical Service Information

Cytec Industries provides technical service assistance for AEROSOL WA-300 Surfactant and other products. Samples of AEROSOL WA-300 Surfactant are available upon request.

Handling and Shipping

Handling and shipping information on the AEROSOL WA-300 Surfactant can be found on the Material Safety Data Sheets for the product

Health and Safety Information

Health and safety information on the AEROSOL WA-300 Surfactant can be found on the Material Safety Data Sheets for the product