



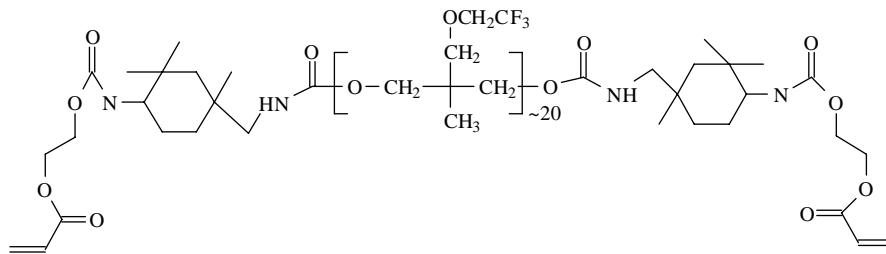
POLYFOX™

the friendly fluorosurfactant

PolyFox™ PF-3320

Fluorinated Oxetane Oligomer with Acrylate Functionality for Improved Performance, Flow, Leveling, and Surface Appearance in UV and EB Coatings

Generic Structure



GENERAL INFORMATION:

PolyFox™ PF-3320 fluorosurfactant is an **environmentally preferred** UV/EB curable fluorosurfactant based on OMNOVA Solutions' platform of poly(oxetane) polymers. PolyFox PF-3320 fluorosurfactant is used in UV/EB curable coatings to improve coating performance, flow, leveling, and surface appearance. PolyFox PF-3320 fluorosurfactant is particularly effective at reducing air entrapment and entrainment while improving surface appearance in UV/EB curable coatings, particularly in coatings with high concentrations of silica matting agents. Such coatings also show improved stain resistance, lower coefficient of friction and improved abrasion resistance. When used properly in formulations, PolyFox fluorosurfactants may be used to replace telomer- based and other conventional fluorosurfactants such as FC-430 from 3M Company. Use of PolyFox fluorosurfactants results in greatly reduced foam, air entrapment, and air entrainment compared to conventional fluorosurfactant technology.

KEY FEATURES AND BENEFITS:

- **Environmentally Preferred** – Compared to certain telomer-based and other conventional fluorosurfactants, PolyFox fluorosurfactants have been found to not bioaccumulate, resulting in very **low environmental impact**.
- **Improved Surface Appearance** – Incorporation of PolyFox fluorosurfactants into coating formulations can result in **improved coating appearance** due to reduced surface defects. In spray applied coatings, PolyFox fluorosurfactants can result in reduced pock marks and cratering, while in roll coat applications their use may result in reduced surface waviness and improved appearance.
- **Outstanding Air Release and De-Aeration** – Incorporation of PolyFox fluorosurfactants in coating formulations results in dramatically reduced air entrainment, thereby dramatically **reducing surface defects** such as pin holes, air trapping and cratering. Elimination of surface defects such as pin holes and air trapping can also result in improved coating durability.
- **Light Color** – Compared to traditional telomer-based and other conventional fluorosurfactant technology, PolyFox fluorosurfactants are **clear, lightly colored, and uniform in appearance**. Use of PolyFox fluorosurfactants will not result in increased color in clear formulations.
- **Excellent Solubility** – PolyFox fluorosurfactants are completely miscible in essentially all commonly used coatings solvents. These products have also been found to be **easily miscible** with polymers such as alkyds, polyesters, cellulosics, acrylics, and 100% solid coatings systems. PolyFox fluorosurfactants, including PolyFox PF-3320, are miscible in monomers and oligomers used in UV/EB curable coatings.

- **Formulation Versatility** – PolyFox fluorosurfactants offer formulators an environmentally preferred alternative to telomer-based and other conventional fluorosurfactant technology without the typical air entrainment problems associated with those technologies, while resulting in improved surface appearance. PolyFox fluorosurfactants' unique surface activities result in their ability to **perform both as a de-aerator and as a flow and leveling agent**. Proper use of PolyFox fluorosurfactants can result in decreased numbers of additives in formulations.
- **Improved Physical Properties** – Use of PolyFox PF-3320 in UV cured coatings result in coatings displaying improved stain resistance, lower coefficient of friction, and improved abrasion resistance.

Table 1. Typical Physical Properties of PolyFox PF-3320 UV/EB Curable Fluorosurfactant *

Physical Form	Colorless to light yellow oil
% Active Ingredient	100
Density (lbs/gal)	~15
Average Functionality	2.0
% Monofunctional	<1.0%
Acrylate Equivalent Weight (g/mole)	2,100 +/-
T_g	-50° C
Viscosity @60°C (cps)	8000
Water Content	<500 ppm
% Fluorine (w/w)	~31
Stability	Stable @ 70°C for 1 hr
Miscibility	Ketones, Esters, Aromatics, Alkanes, Chlorinated Alkanes, Simple Alcohols
*Not actual product specifications	

In 100% solids UV/EB curable coatings, traditional fluorosurfactant technology can promote or result in foaming, air entrapment, and pin holes, thereby resulting in surface defects and decreased coating performance. However, use of OMNOVA's environmentally preferred fluorosurfactant technology, such as PolyFox PF-3320, results in significantly reduced foaming and air entrainment resulting in improved coating manufacture, quality control, and surface appearance. Incorporation of PolyFox PF-3320 fluorosurfactants into coatings highly matted with silica matting agents appear to result in a more uniform distribution of silica flattening agent resulting in less silica agglomeration and more uniform particle size. This may be due to the PolyFox PF-3320 material entraining less air during the pigment dispersing phase, allowing the resin system to act uniformly on the silica particle itself. Uniform dispersion of the matting agent may result in improved coating gloss uniformity, and results in overall smoother coating appearance. Figure 1 below compares density values in a matted UV coating for PolyFox PF-3320 fluorosurfactant versus a commercial fluorosurfactant, a commercial wetting and flow agent for UV curable coatings, and a commercial de-aerator designed for UV curable coatings. Figure 2 compares the appearance of a PolyFox PF-3320 modified coating applied by roll application, versus a commercial fluorosurfactant. That figure shows that incorporation of PolyFox PF-3320 fluorosurfactant results in improved silica incorporation and less flattening agent agglomeration. Figures 3 and 4 show that incorporation of PolyFox PF-3320 in matted UV curable coatings result in films with less numbers of air bubbles and less air bubble surface area per total coating area resulting in improved matted coating clarity with less haze as compared to commercial wetting agents and de-aerators.

Figure 1. PolyFox PF-3320 Density Values Versus Various Additives for Freshly Blended Matted UV Curable Coating

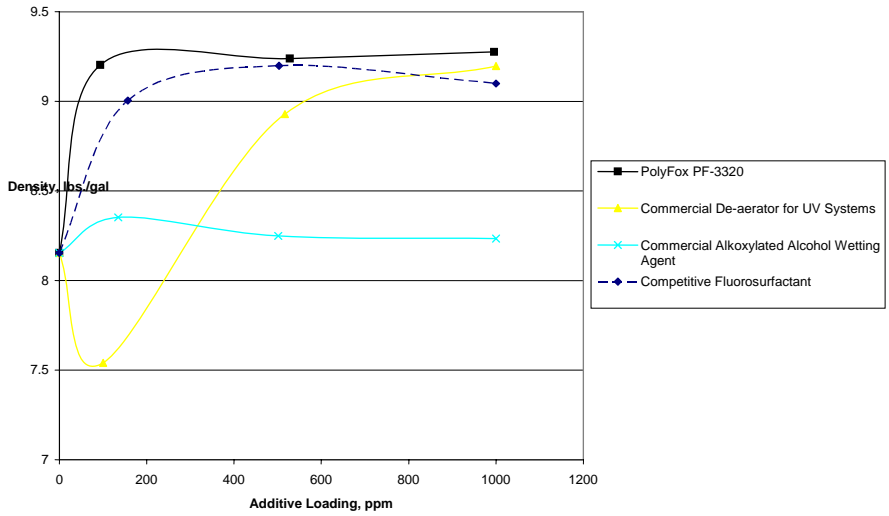


Figure 2 shows an example of improved silica incorporation, less flattening agent agglomeration, and improved appearance in a matted UV curable coating modified with PolyFox PF-3320 compared to a commercial fluorosurfactant. Coatings were applied by roll application

Figure 2. PolyFox fluorosurfactant performance enhancement in matted UV cured coating (Roller Coat)



Matte UV Cure Coating With
156.6 ppm FC-430



Matte UV Cure Coating With
503.2 ppm FC-430



Matte UV Cure Coating With
93.8 ppm PolyFox PF-3320



Matte UV Cure Coating With
528.3 ppm PolyFox PF-3320

Figure 3 shows that coatings using PolyFox PF-3320 fluorosurfactant have improved de-aeration in terms of less total number of air bubbles and less total air bubble surface coverage in a freshly agitated matted UV coating as compared to a conventional telomer based fluorosurfactant and other commercial surfactants and de-aerators.

Figure 3a. Number of Bubbles Counted per 6.6 mm² for Each Additive after Immediate Agitation

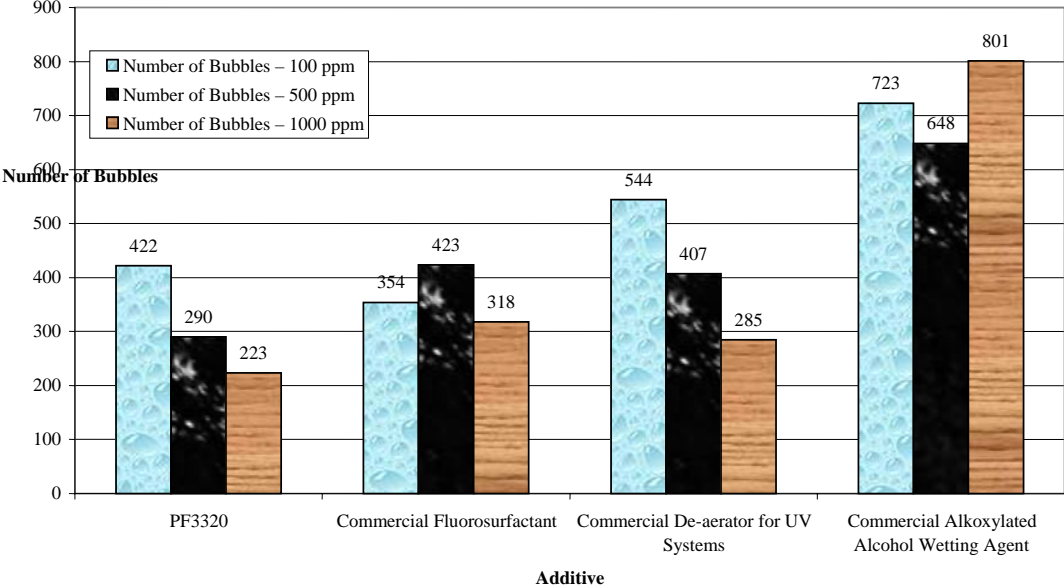


Figure 3b. Per-Area Value for Additives after Immediate Agitation

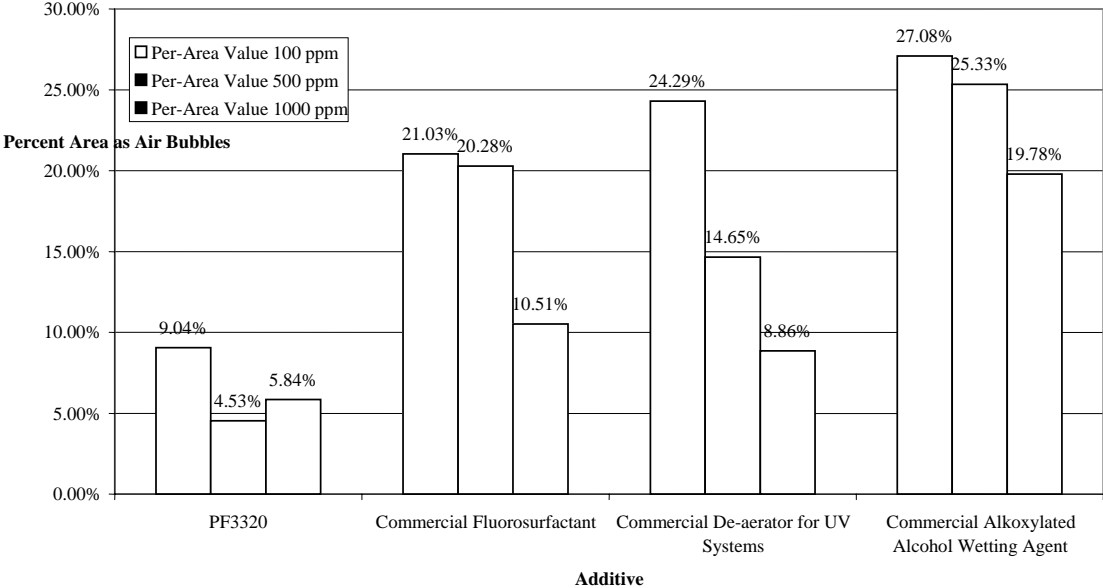
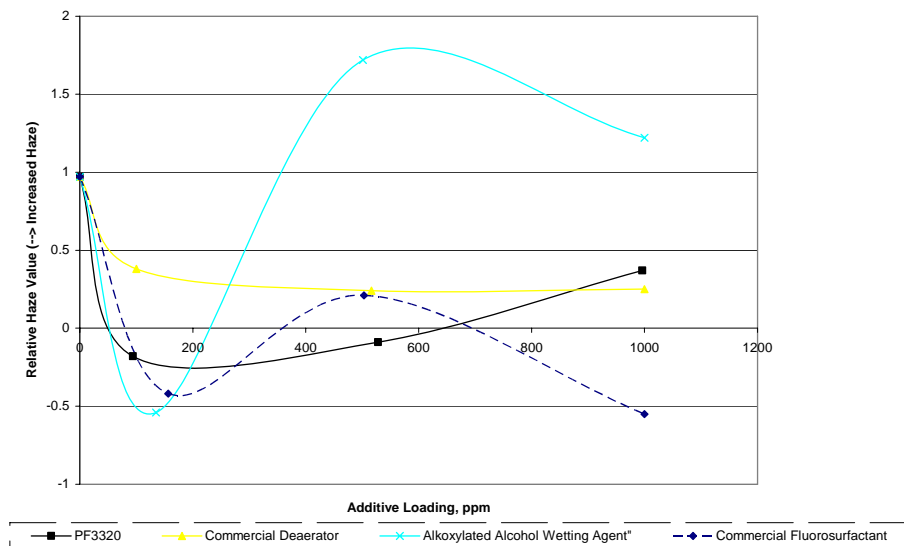


Figure 4 shows how the addition of PolyFox PF-3320 fluorosurfactant to a flatted UV cured coating results in decreased haze values relative to the coating with no additive.

Figure 4. Relative Haze Versus Additive Loading



In UV/EB cured coatings, PolyFox fluorosurfactants are environmentally preferred compared to conventional fluorosurfactants. PolyFox PF-3320 has excellent miscibility, excellent color and clarity, and significantly improved de-aeration and air release. These characteristics result in improved coating appearance and performance. Table 2 displays an example of a starting point formulation utilizing PolyFox PF-3320 in a roller applied flatted UV cure coating.

Table 2. Flatted UV Cure Coating Incorporating PolyFox PF-3320

Item	Weight %	Supplier
Laromer™ PE55F	17.63	BASF
Laromer™ PE44F	16.06	BASF
Ebecryl™ 264	24.49	Cytec Surface Specialties
Laromer™ HDDA	12.18	BASF
Sartomer™ SR344	16.23	Sartomer
Irgacure™ 184	4.27	Ciba
Syloid™ 7000	9.09	Dow
PolyFox™ PF-3320	0.05	
Total	100.00	

Products (items) listed in the chart above are the trademarks of the supplier indicated.

Learn More

Find out how PolyFox™ fluorosurfactants can improve appearance and performance in your coatings. Call (714) 273-9182 or email eric.rall@omnova.com for samples, literature, or technical assistance or visit our website at www.omnova.com

NOTE:

Although data supplied above are believed to be accurate, each user is advised to make his or her own determination as to whether the described product(s) is/are appropriate for a particular use or application, whether such a use will comply with all applicable laws or regulations, or whether such a use will not infringe the intellectual property rights of third parties.



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