



# Research & Development Report RDR#7002 Energy-Curable OPV Manufacturers

**To:** Energy-Curable OPV Manufacturers  
**From:** ESP Technical Services Department  
**Date:** July 23, 2008

## **Objective:**

Various customers within the graphics market have experienced foaming and printability issues in energy-curable systems. A number of competitive antifoams exist based on silicone and non-silicone chemistry. ESP has been requested to develop a foam control agent that will control foam in their systems with minimal affect on gloss and film cast properties. An evaluation of ESP's new introduction is will be compared to current competitive offerings in a variety of UV-curable graphic arts systems.

## **Summary of Results:**

FC 983 offers improved foam control over each of the competitive test candidates as tested. FC 983 offered unmatched foam control under shear conditions, while its control of air-induced foam was only matched by one competitive product. Film-formation characteristics shows FC 983 to be equal or better than all silicone-based additives as tested.

## **Method of Evaluation:**

Test samples were generated by using different energy-curable systems, formulated using raw materials commonly available and in use in the industry. EBECRYL™ oligimers, ADDITOL™ photoinitiators, and market-accepted monomers were provided by Cytec Industries Inc.<sup>1</sup> and wax additives were supplied by Micro Powders Inc.<sup>2</sup> (detailed formulations available upon request). Test formulas used for these evaluations were developed based on consultation and discussions with ESP customers and raw material suppliers. The systems represented varied end-use application processes and substrates: System "A"= UV screen coating for paper; System "B"= UV flexo coating for paper; System "C"= UV flexo coating for films; System "D"= EB flexo ink for films; and System "E" = customer-supplied high-gloss UV coating of unknown composition.

All candidates were tested at uniform weight basis, except as noted. Defoamers were screened in each media for foam control under shear and filmcast properties. Results can be found in Tables I-V. Foam control was also evaluated for certain candidates in System "B" using sparged air, to evaluate foam control as a function of time. These results are viewable in Table VI and Graph I.

Material Provided By:

<sup>1</sup>Cytec Industries Inc.  
Cytec Product Referral  
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Woodland Park, NJ 07424  
Telephone: 800-652-6013, or 973-357-3193  
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*"Additol" and "Ebecryl" are trademarks of Cytec Industries, Inc.*

<sup>2</sup>Micro Powders Inc.  
580 White Plains Road  
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**Table I: Initial Foam Control Evaluations, Media A**

**Media:** Screen Coating  
**Viscosity:** 625 cPs (Brookfield RVT; #3 spindle @ 100 rpm)  
**Test Method:** ESP TSM#143  
**Filmcast Test Equipment:** 300-Mesh Screen  
**Media Density, unfoamed:** 8.923 lb/gal

Candidate	Dosage	Foam Density (lb/gal)	Film-Cast Rating	Filmcast Comments
Blank (undosed)	0.0%	6.923	-4	Bubbles throughout
<b>ESP's FC 983</b>	0.5%	8.293	-1	Slight mottle
<b>B-A501</b>	0.5%	6.901	-0	No apparent foam
<b>B-088</b>	0.5%	7.409	-3	Slight mottle
<b>A-900</b>	0.5%	8.063	-1	Slight mottle
<b>A-920</b>	0.5%	7.607	-1	No apparent foam
<b>FB 20F</b>	0.5%	8.077	-2	Slight mottle
<b>FB 550</b>	0.5%	7.609	0	No apparent foam
<b>ESP's FC 220</b>	1.0%	8.201	0	Slight mottle
<b>ESP's FC 425</b>	1.0%	7.121	-4	Bubbles throughout

**Table II: Foam Control Evaluations, Media B**

**Media:** UV Flexo Paper Coating  
**Viscosity:** 230 cPs (Brookfield RVT; #3 spindle @ 100 rpm)  
**Test Method:** ESP TSM#143  
**Media Density, unfoamed:** 8.856 lb/gal

Candidate	Dosage	Initial Foam Density (lb/gal)	Initial Film-Cast Rating	Aged Density (lb/gal)	Aged Film-Cast Rating
Blank	0.0%	6.992	0	6.957	0
<b>ESP's FC 983</b>	0.5%	8.433	-2.5	8.414	-2.5
<b>B-501</b>	0.5%	6.884	0	----	----
<b>FB 20F</b>	0.5%	8.318	-3	8.282	-3
<b>A-900</b>	0.5%	8.163	-4	8.196	-3.5
<b>A-920</b>	0.5%	7.649	-3	7.558	-2
<b>ESP's FC 425</b>	0.5%	7.054	-1	7.565	-1

**Table III: Initial Foam Control Evaluations, Media C**

**Media:** UV Flexo Film Coating  
**Viscosity:** 130 cPs (Brookfield RVT; #3 spindle @ 100 rpm)  
**Test Method:** ESP TSM#143  
**Media Density, unfoamed:** 8.659 lb/gal

Candidate	Dosage	Density (lb/gal)	Film-Cast Rating
Blank (undosed)	0.0%	7.451	-3†
ESP's FC 983	0.5%	8.260	-3†
B-A501	0.5%	7.412	-3†
A-900	0.5%	8.160	-3†
A-920	0.5%	7.428	-3†
FB 550	0.5%	7.268	-3†

†the undosed coating possessed inherent film-formation deficiencies; formula to be adjusted for improved leveling of the media.

**Table IV: Initial Foam Control Evaluations, Media D**

**Media:** EB Flexo Film Coating  
**Viscosity:** 195 cPs (Brookfield RVT; #3 spindle @ 100 rpm)  
**Test Method:** ESP TSM#143  
**Media Density, unfoamed:** 8.749 lb/gal

Candidate	Dosage	Density (lb/gal)	Film-Cast Rating
Blank (undosed)	0.0%	7.306	0
ESP's FC 983	0.5%	8.267	-3
B-A501	0.5%	7.441	-0.5
A-900	0.5%	8.104	-3.0
A-920	0.5%	8.057	-1.5

**Table V: Initial Foam Control Evaluations, Media E**

**Media:** Customer-Supplied High-Gloss UV Coating  
**Viscosity:** 210 cPs (Brookfield RVT; #3 spindle @ 100 rpm)  
**Test Method:** ESP TSM#143  
**Media Density, unfoamed:** 9.313 lb/gal

Candidate	Dosage	Density (lb/gal)	Film-Cast Rating
Blank (undosed)	0.0%	6.553	0
ESP's FC 983	0.5%	8.501	-2
A-900	0.5%	8.271	-2
B-067A	0.5%	7.267	0
B-088	0.5%	7.419	0
B-020	0.5%	7.832	-4

**Table VI: Initial Foam Control Evaluations, Media B**  
 (Foam Height at \_\_\_\_ seconds)

**Media:** UV Flexo Paper Coating  
**Viscosity:** 230 cPs (Brookfield RVT; #3 spindle @ 100 rpm)  
**Test Method:** ESP TSM#110

Defoamer Candidate	Dose	0	5	10	20	30	45	60	90	120	180	KD*
Blank	0.00%	40	89	127	---	---	---	---	---	---	---	---
ESP's FC 983	0.50%	40	52	52	52	52	52	52	54	54	54	41
A-900	0.50%	40	52	52	52	52	52	52	52	54	54	41
FB 20F	0.50%	40	59	62	64	66	68	70	72	74	76	48

**Graph I: Initial Foam Control - Media B**

