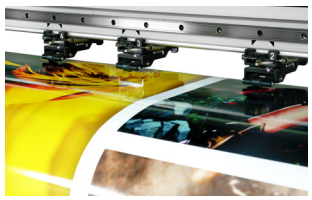
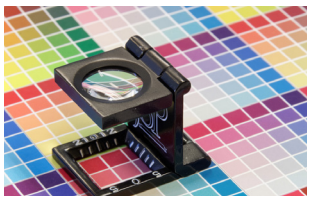
WATERBORNE RESINS FOR UV INKJET AND OPV APPLICATIONS

UCECOAT® UV/EB Energy-Curable Resins - Technical Bulletin











October 2018

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The Coating Resins Company

RADCURE

Waterborne UV resins provide environmentally-friendly opportunities with performance that can exceed 100% UV resins, but without requiring dilution solvents or monomers for low viscosity applications such as Over Print Varnishes and Inkjet Inks. The absence of low molecular weight monomers and the higher molecular weight of the resin makes waterborne UV a good choice for low migration applications. Their water resolubility before cure is also an appreciated prerequisite for robust printing without comprimising the final ink performance after cure.

PRODUCTS

UCECOAT 2801
Versatile binder with good stability, reactivity and water resolubility

UCECOAT 2802
Versatile binder specifically designed for application onto flexible PVC

UCECOAT 2803
Versatile binder with excellent pigment wetting and resistance properties

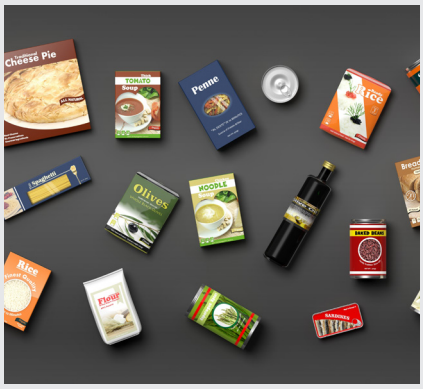
UCECOAT 2804
Low migration binder with very high reactivity (both in UV and LED) and good adhesion onto plastic substrates

UCECOAT 2805
Low migration binder with good elongation properties and high ink stability due to very small particle size

UCECOAT 2806
Low migration binder with very low viscosity, low surface tension and good water resolubility

UCECOAT®
Target applications

Packaging



Commercial Printing



Plastics



And many more...

► Product Selection Guide

	Tack-free	Resolubility	Label-free	BPA-free	Tin-free	Low Migration
UCECOAT 2801						
UCECOAT 2802						
UCECOAT 2803						
UCECOAT 2804						
UCECOAT 2805						
UCECOAT 2806						

► Typical Properties

	% Solids	Viscosity, 25°C (mPa.s)	pH	Average Particle size (nm)	Surface Tension (mN/m)
UCECOAT **2801**	38	15	6.7	90	35
UCECOAT **2802**	38	200	7.3	80	35
UCECOAT **2803**	40	300	7.5	75	41
UCECOAT **2804**	35	75	7.5	100	43
UCECOAT **2805**	35	100	8.0	20	39
UCECOAT **2806**	35	10	6.7	75	32

► Typical Tensile Properties

	Young's Modulus (mPa/Kpsi)	Tensile Strength (MPa/ Kpsi)	Elongation At Break (%)
UCECOAT **2801**	1,250/180	30/4	8
UCECOAT **2802**	900/130	30/4	16
UCECOAT **2803**	1,100/160	34/5	7
UCECOAT **2804**	1,900/275	6/1	< 1
UCECOAT **2805**	1,400/200	45/6	10
UCECOAT **2806**	1,900/275	13/2	< 1

Measured on a 80-100µ EB-cured film (5 mRad - 250 kV)

WATER-BASED UV OPV FORMULATIONS

The final properties of UV cured formulations specifically depend on the selection of formulation components such as additives (thickeners, levelling agents, antifoam agents...) and photoinitiators (e.g. BCPK, HDMAP, TPO-L).

The photoinitiator should be pre-dispersed in water before addition:

Component	%	Comments
Water	45.5	
Tego® disperse 755W (Evonik)	4.5	Wetting and dispersing additive
BYK® 3455 (BYK)	4.5	Levelling agent
Photoinitiator	45.5	

► STARTING POINT FORMULATION FOR A UV-CURABLE OPV

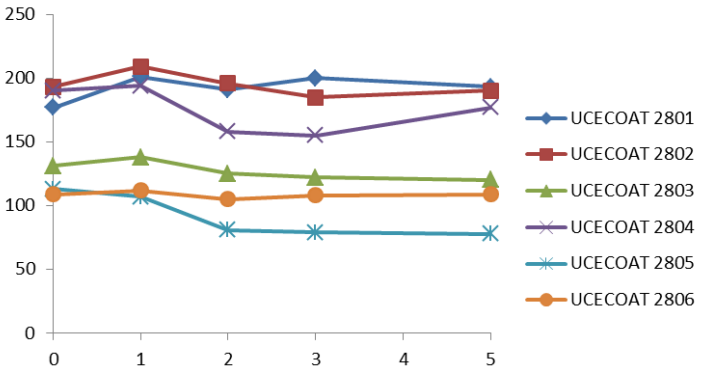
	UCECOAT **2801**	UCECOAT **2802**	UCECOAT **2803**	UCECOAT **2804**	UCECOAT **2805**	UCECOAT **2806**
UCECOAT®	96.3	96.1	96.0	96.5	96.5	96.5
BCPK (45.5% in water)				3.5		
HDMAP (45.5% in water)	3.7		4.0		3.5	
TPO-L (45.5% in water)		3.9				3.5
ADDITOL® VXW6360 (50% in water)		1.0				
Tagifel® pur 54 *	1.5			1.0		2.5
TEGO® Wet 270 **	0.4	0.4	0.4	0.4	0.4	0.4
Total	101.9	101.4	100.4	101.4	100.4	102.9

Viscosity at 25°C between 100-300 mPa.s.

***** Thickener from MÜNZING CHEMIE GmbH. ****** Levelling agent from EVONIK.

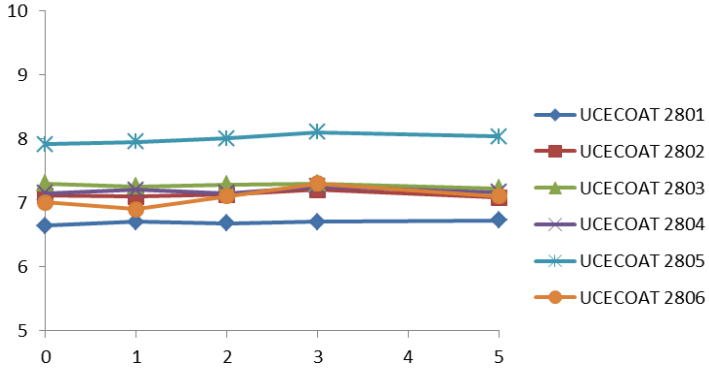
► Formulation Stability of OPV

Viscosity (mPa.s) at 25°C



Time (months) at room temperature

pH

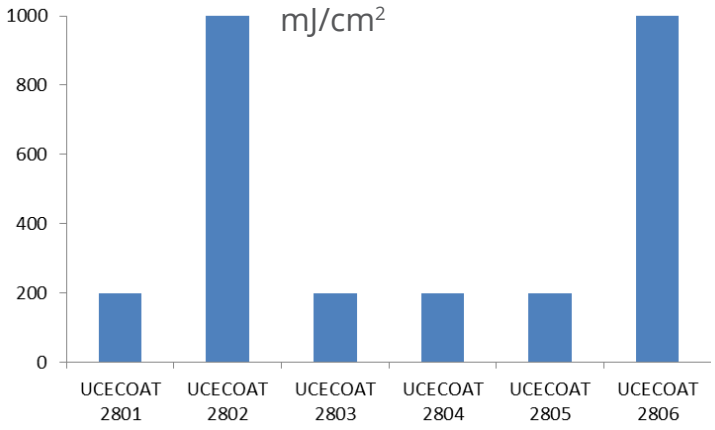


Time (months) at room temperature

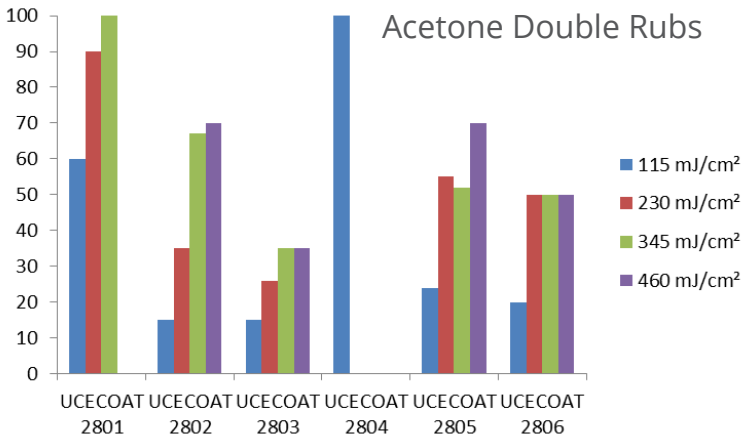
Formulations are stable over time.

► APPLICATION RESULTS FOR OPV

► Surface Cure



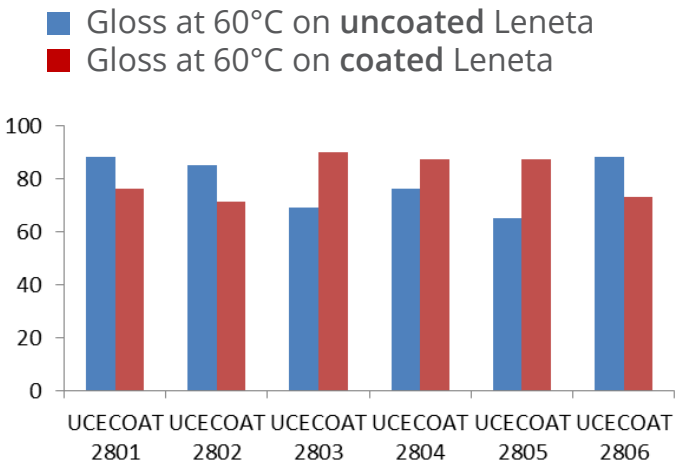
► Depth Cure



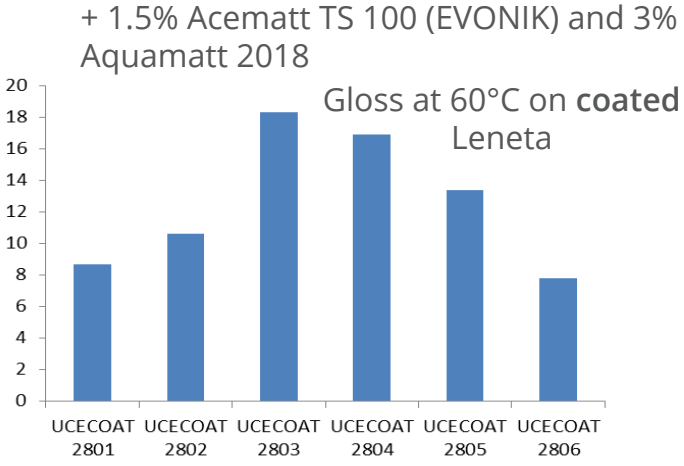
Application: 6 µm dry film on uncoated Leneta chart - Flass-off water: 2 minutes at 60°C.

UCECOAT 2804 is by far the most reactive UV PUD in the range.

► Gloss

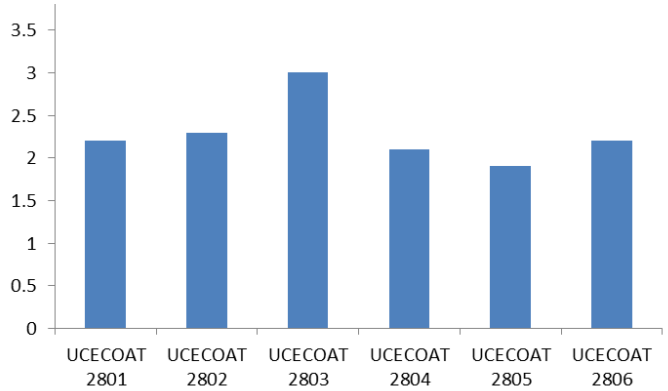


► Matt



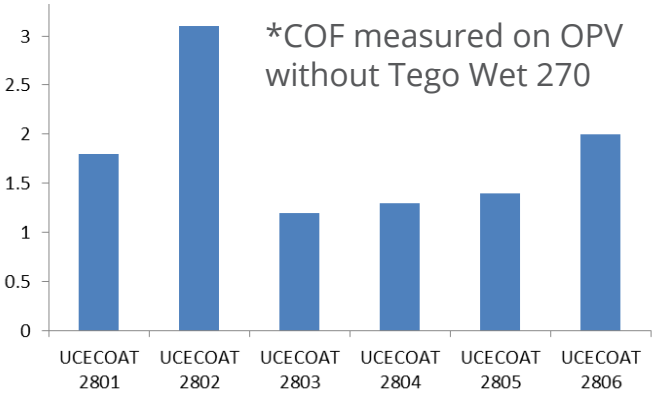
High gloss levels as well as (dead) matte finishes can easily be achieved!

► Yellowing (Δb)



Yellowing upon cure is low!

► SLIP (Coefficient of Friction*)



UCECOAT 2802 results in the highest COF.

► APPLICATION RESULTS FOR OPV (CONTINUED)

► Adhesion on plastics

	(Tape TESA 4104)	UCECOAT **2801**	UCECOAT **2802**	UCECOAT **2803**	UCECOAT **2804**	UCECOAT **2805**	UCECOAT **2806**
BOPP*	**C58** (Innovia)						
PE*							
PVC	**Genotherm shrink** (Pentaplast)						
PA							
PET*	**Melinex 800** (DuPont Teijin)						
PC	**Lexan 8010** (Sabic)						

Where good adhesion to plastics is needed, UCECOAT 2804 is the best option!

Tape adhesion test performed on formulations without Tego Wet 270!

* Corona treated

WATER-BASED UV INKJET FORMULATIONS

STABILITY	Time evolution at elevated temperature (45-60°C) of viscosity, pH, particle size, coagulum
FILTERABILITY	Capacity to be filtered efficiently for good nozzle flow in the print head
JETTABILITY	Consistency of droplets formation at the nozzles as a function of rheology and surface tension
RESOLUBILITY	Resolubility of the dry ink in water to reduce drying and clogging of the print head nozzles
REACTIVITY	Curing speed and effectiveness to provide full ink performance with usual or LED cure
ADHESION	Adhesion to substrates in relation with ink shrinkage upon cure
RESISTANCE	Mechanical and chemical resistance of the printed material under intended usage

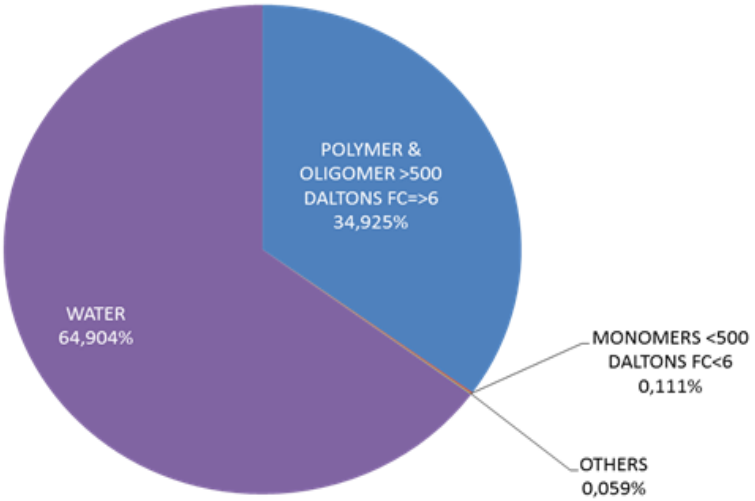
► STARTING POINT FORMULATION FOR A UV-CURABLE INKJET INK*

	STEP 1: **Pigment Dispersion**	
Water		13.85
BYKJET-9151	pigment wetting	2.00
BYK-019	defoamer	0.10
Acticide® MBS (Thor)	biocide	0.05
Heliogen Blue D7076 (PB 15:3)		4.00
	STEP 2: **To Be Added To Pigment Dispersion**	
UCECOAT 2801		24.00
Water		32.90
Propylene glycol		19.00
BYK-348	substrate wetting (silicone)	0.10
BYK-DYNWET 800N	substrate wetting (silicone-free)	1.00
Photoinitiator (e.g. Omnirad 2959 from IGM)		3.00
		100.00

***** In collaboration with BYK-Chemie.

STRATEGY FOR NOVEL LOW MIGRATION UV PUDs

1. Eliminate chemicals of concern (Sn, BPA, APEO, solvent…)
2. Maximize acrylates with molecular weight > 500 Daltons AND Fc ≥ 6
3. Control composition for specific requirements (e.g. resolubility)
4. Validate low migration and [indirect] food contact compliance



UCECOAT 2804 contains about 99.5% of solids of molecular weight above 500 Daltons AND an acrylate functionality of 6 or higher.

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