



UCECOAT[®] Waterborne UV Resins for Field Applied Wood and VCT Floor Finishes

UCECOAT waterborne UV resins are recommended for use in field applied wood and VCT (vinyl composition tile) top coats. The low viscosity of **UCECOAT** resins, obtained without the use of low molecular weight acrylate diluents, provides ease of application in the field with minimal coating penetration into the substrate. **UCECOAT** resins that are tack-free before cure are typically used to avoid dust pick-up and/or damage to uncured coatings.

The choice of **UCECOAT** waterborne UV resin is based on the desired final coating properties. Toughness, flexibility, chemical resistance, hardness, abrasion resistance, cure speed, and adhesion are some of those properties that can be provided. Tables 1 and 2 provide information on the **UCECOAT** resins that are recommended for use in field applied wood and VCT floor finishes. General starting point formulations for field applied gloss and matte wood and VCT top coats are given in Tables 3 and 4. The performance properties of the gloss and matte coatings are shown in Table 5. These properties are for one coat of gloss and two coats of matte applied to oak wood prepared with two coats of waterbased sealer, and for one coat of gloss on VCT. All coatings were lightly sanded before recoating. Lab work has also shown that coating properties are essentially the same for a one or two topcoat finish.

Field applied UV curable floor finishes provide advantages for both contractors and customers. The most important advantage is fast return to service. Since UV curable coatings have fully developed properties immediately after cure, return to traffic and replacement of rugs can occur immediately after the UV curing step. For multiple topcoat systems, recoats can occur after water evaporation but before UV cure if the formulation is tack free after water evaporation. This two coat system can then be UV cured at the same time without a loss of properties. Waterbased UV curable coatings are 1K systems, with no waste or performance issues related to potlife. These coatings are also low/no odor, non-flammable, non-hazardous, and very low VOC. The finished coating is easy to clean, has excellent properties, and can be formulated to have excellent exterior durability. Table 6 compares commercially available conventional wood floor finishes to the UV curable matte starting point formulation. It clearly shows the benefits of a UV curable wood floor finish.

Recent advances in portable UV curable equipment have made the instantaneous cure of floor coatings possible. There are multiple suppliers of UV curing equipment. To insure a successful floor finish, floor coating formulations should be tested with the same equipment that will be used in the field.



FEATURED PRODUCT SHEET

TABLE 1. Typical Properties of UCECOAT Waterborne UV Resins that are Tack Free Before Cure

UCECOAT WATERBORNE UV RESIN	UCECOAT 7571	UCECOAT 7655	UCECOAT 7689	UCECOAT 7699	UCECOAT 7890
Product Description	Acrylated Polyurethane Dispersion	Acrylated Polyurethane Dispersion	Acrylated Polyurethane Dispersion	Acrylated Polyurethane Dispersion	Acrylated Polyurethane Dispersion
Properties	Balance of hardness and flexibility	Superior hardness and scratch resistance; excellent stain resistance	Excellent exterior durability	Very high reactivity in clear and pigmented systems; good pigment and particle wetting	Good foam control and wetting; good balance of flexibility and hardness; excellent stain resistance
Tack free before cure	Yes	Yes	Yes	Yes	Yes
Appearance	Translucent to white liquid	Translucent to white liquid	Translucent to white liquid	Translucent to white liquid	Translucent to white liquid
Viscosity (cP @ 25 °C)	< 200	< 200	< 200	< 200	< 200
Solid Content (%)	35	35	35	35	35
pH	7.0 – 8.5	7.0 – 8.5	7.0 – 8.5	7.0 – 8.5	6.0 – 8.5
Particle Size (nm)	< 100	< 150	< 100	< 150	< 150
MFFT (°C)	< 0	< 0	0	6	~ 0
Density (g/ml @ 25 °C)	1.0	1.02	1.0	1.0	1.05

TABLE 2. Typical Properties of UCECOAT Waterborne UV Resins that are Not Tack Free Before Cure

UCECOAT WATERBORNE UV RESIN	UCECOAT 7674
Product Description	Acrylated Polyurethane Dispersion
Properties	Excellent wetting of and adhesion to wood
Tack free before cure	No
Appearance	Translucent to white liquid
Viscosity (cP @ 25 °C)	< 200
Solid Content (%)	35
pH	7.0 – 8.5
Particle Size (nm)	< 150
MFFT (°C)	< 0
Density (g/ml @ 25 °C)	1.05



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TABLE 3. Starting Point Formulation for Gloss Wood or VCT Top Coat

PRODUCT	PERCENT	PURPOSE / PROPERTY
UCECOAT 7655	90.82 - 93.32	Resin for desired coating properties
ADDITOL [®] VXW 4973	0.18	Additive for foam control
BYK [®] UV 3500 (BYK Additives & Instruments)	2.00 – 2.50	Additive for flow and leveling
Butyl Carbitol	1.00 – 3.00	Solvent for film coalescence
ADDITOL [®] BCPK	3.50	Photoinitiator for surface and through cure
	100.00	
Coat at 5-7 mils with a T-bar or flat pad applicator on stained/sealed wood* or VCT, and allow to dry (typically 2-3 hours)		
UV cure at exposure necessary to get a mar free surface (mJ/cm²)	300 typical	Crosslinked polymer for resistance properties and aesthetics

ADDITOL is a trademark of Cytec Industries Inc.

COATING PREPARATION: All additions are done under high speed agitation. Slowly add the ADDITOL VXW 4973 to the UCECOAT 7655. Preblend the remaining components, and then add to the UCECOAT mixture. Filter the mixture through a 190 micron filter. Allow to de-air for 24 hours before use.

Higher concentrations of BYK UV 3500 and butyl carbitol are recommended for VCT substrates. The lowest concentrations are recommended for wood substrates.

The photoinitiator concentration should be optimized for the UV curing equipment and for the desired cure speed and performance properties. Levels of 1.0 – 3.5% have been shown to give the same coating properties under the listed cure conditions.

* The wood should be stained/sealed before applying the topcoat. Exhaustive testing of stain/sealers for compatibility and performance has not been done. Waterborne and solventborne stains/sealers from Pro-Finisher, Behr, and Zinsser performed well in Cytec lab testing.

To insure performance of the coating, application of UV curable field applied floor coatings should be done by trained equipment operators.



FEATURED PRODUCT SHEET

TABLE 4. Starting Point Formulation for Matte Wood or VCT Top Coat

PRODUCT	PERCENT	PURPOSE / PROPERTY
UCECOAT 7890	89.32	Resin for desired coating properties
Deionized Water	0.50	Diluent for viscosity/pH adjustment
28% Ammonium Hydroxide Solution (EMD Chemicals)	0.50	Base for pH adjustment
Gasil [®] 23F (PQ Corporation)	3.00	Matting agent for gloss reduction
ADDITOL [®] VXW 4973	0.18	Additive for foam control
Butyl Carbitol (The Dow Chemical Company)	1.00	Coalescing agent for film formation
BYK [®] UV 3500 (BYK Additives & Instruments)	2.00	Additive for flow and leveling
ADDITOL [®] BCPK	3.50	Photoinitiator for surface and through cure
	100.00	
Coat at 5-7 mils with a T-bar or flat pad applicator on stained/sealed wood* or VCT, and allow to dry (typically 2-3 hours)		
UV cure at exposure necessary to get a mar free surface (mJ/cm ²)	300 typical	Crosslinked polymer for resistance properties and aesthetics

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COATING PREPARATION: All additions are done under high speed agitation. Preblend the water and ammonium hydroxide, and add to the UCECOAT 7890 to adjust pH to >8.0. Slowly add the matting agent. After the addition is complete, continue agitating for an additional 20-25 minutes. Slowly add the defoamer. Preblend the remaining components, and add to the UCECOAT mixture. Agitate an additional 5 minutes. Filter the mixture through a 190 micron filter. Allow to de-air for 24 hours before use.

The photoinitiator concentration should be optimized for the UV curing equipment and for the desired cure speed and performance properties. Levels of 1.0 – 3.5% have been shown to give the same coating properties under the listed cure conditions.

* The wood should be stained/sealed before applying the topcoat. Exhaustive testing of stain/sealers for compatibility and performance has not been done. Waterborne and solventborne stains/sealers from Pro-Finisher, Behr, and Zinsser performed well in Cytec lab testing.

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TABLE 5. Performance Properties of Wood or VCT Top Coats

PROPERTY	GLOSS COATING ON VCT	GLOSS COATING ON WOOD	MATTE COATING ON WOOD
Gloss (60 °)	84	80	25
Appearance	High clarity; No surface defects	High clarity; No surface defects	Uniformly matte; No surface defects
Crosscut Adhesion (610 tape)	5B	5B	5B
Nickel Test	Very slight burnish	Very slight burnish	Very slight burnish
Black Heel Mark Resistance (BHMR)	No marking	Black marks; easily removed	No marking
Pencil Hardness	4B	3B	H
MEK Double Rubs	200+	200+	200+
Chemical Resistance (24 hour spot test, with cottonball, covered)			
Mustard	No stain or distortion	No stain or distortion	No stain or distortion
Betadine	No stain or distortion	No stain or distortion	No stain or distortion
RIT [®] Dye (navy, undiluted)	No stain or distortion	Slight stain (not tested at 30 minutes)	Slight stain (no stain at 30 minutes)
Xylene	Moderate distortion	No stain or distortion	No stain or distortion
Olive Oil	No stain or distortion	No stain or distortion	No stain or distortion
Formula 409 [®]	No stain or distortion	No stain or distortion	No stain or distortion
Vinegar	No stain or distortion	No stain or distortion	No stain or distortion
Water	No stain or distortion	No stain or distortion	No stain or distortion
Ethanol (50%)	Slight distortion	Slight stain	No stain or distortion
Isopropanol (99%)	No stain or distortion	No stain or distortion	No stain or distortion
Isopropanol (70%)	Slight distortion	No stain or distortion	No stain or distortion
Windex [®]	No stain or distortion	No stain or distortion	Slight stain (no stain at 30 minutes)

TABLE 6. Benefits of a UV Curable Wood Floor Finish

PROPERTY	TECHNOLOGY				
	1K OIL MODIFIED PU	1K WATER-BORNE PU	2K WATER-BORNE PU	2K WATER-BORNE PU	1K WATER-BASED UV PU
Cure Type	Oxidative	Oxidative	Aziridine	Isocyanate	UV
Pot Life (hours)	n/a	n/a	8-24	4-6	n/a
Dry Time between Topcoats (hours)	8-12	2-3	2-3	2-3	2-4
Time to Light Traffic (hours)	24	24	24	24	Immediate after UV cure
Time to Rug Replacement (days)	14	7-14	7-14	7	Immediate after UV cure
VOC (g/l)	450-550	220-350	235-390	240-350	<200
Flashpoint (°F)	110	>200	>200	>200	>200
Price (\$/500 sq ft coverage)	25	38	62	116	150
Adhesion	+	++	++	++	++
Nickel Test	-	- - -	+	+	+
Black Heel Mark Resistance	++	+	++	++	++
Pencil Hardness	-	-	-	+	++
MEK Double Rubs	+	- -	+	-	++
Chemical Resistance	-	- -	-	-	++

Information on conventional floor finishes was obtained from product brochures, data sheets, and MSDS's.

Relative coating properties for all floor finishes were obtained from a coating system applied to oak wood panels. The coating system consisted of two coats of waterbased sealer and two coats of finish applied at 5-7 mils. All coatings were lightly sanded before recoating.

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