CYTEC

TECHNICAL BULLETIN Energy Curable Resins

Accelerated Weathering of UCECOAT® Waterborne UV Resins

Introduction

UCECOAT waterborne UV resins are aqueous dispersions of urethane acrylate oligomers in water (UV PUDs). This bulletin summarizes the gloss retention and resistance to yellowing after accelerated weathering of the UCECOAT materials available in North America. The study does not include UCECOAT 7578, which is based on an aromatic isocyanate and is not designed to have exterior durability.

Procedure

UCECOAT blends were prepared by adding the photoinitiator and rheology modifier to the UCECOAT using a Cowles blade for agitation, according to the formula below. Note that the formulations do not include any UV absorbers (UVAs) or hindered amine light stabilizers (HALS).

Raw Material	Function	Wt. %
UCECOAT	Binder	96.5
ADDITOL® BCPK	Photoinitiator	1.5
ADDITOL VXW 6360(1)	Rheology Modifier	2.0

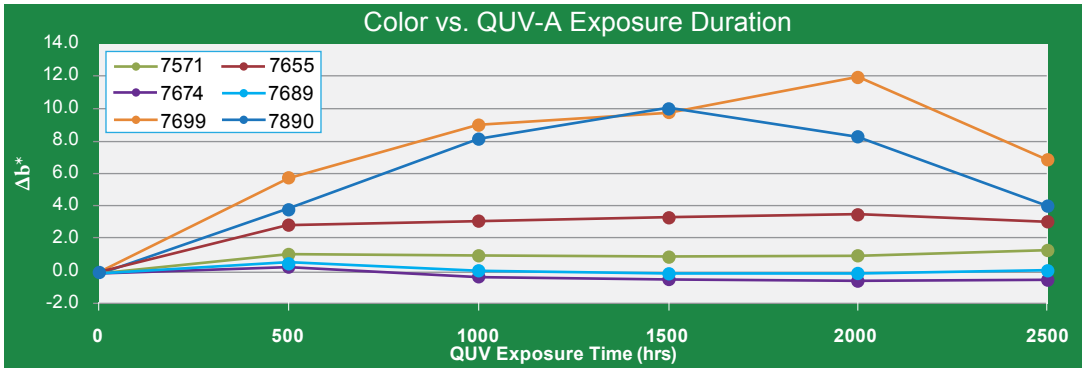
The UCECOAT formulations were drawn down onto aluminum panels that had been coated with a white super durable powder coating, dried in a 50°C oven for 5 minutes and cured at 50 fpm using 2 medium pressure mercury lamps ("H" bulbs). The dry film thickness was 0.7 ± 0.1 mils (18 ± 2.5µ). After the initial color and gloss were measured, the panels were placed in a QUV-A cabinet with an exposure cycle of 8 hours UV at 50°C followed by 2 hours condensation at 40°C. The color and gloss were followed as a function of exposure time.

Results

Color Change

The change in color as a function of exposure time is displayed for each UCECOAT in the chart in Figure 1. Two of the UCECOATs, UCECOAT 7674 and 7689, show an exceptionally low change in color over the duration of the test (Δb* < 0.5) while a third resin, UCECOAT 7571, shows a low degree of color change (Δb* <1.5). The yellowing resistance of these three resins is comparable to the best weathering 100% solids UV curable resins commercially available today(2). UCECOAT 7655 exhibits a slightly higher degree of yellowing on exposure and UCECOATs 7890 and 7699 have the highest level of yellowing followed by some bleaching near the end of the exposure period.

Figure 1. Color change (Δb) as a function of QUV-A exposure time



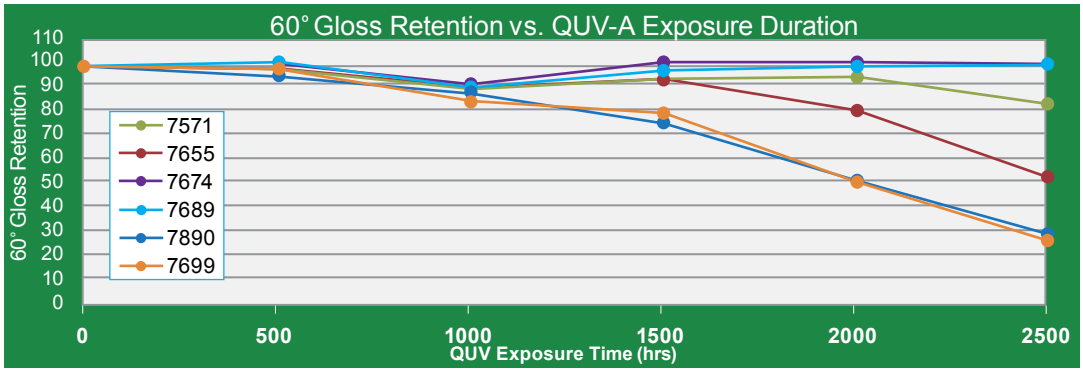
(1) Mixed 1:1 with water prior to addition
(2) Cured Coatings

Refer to Technical Bulletin: Weathering Studies - 5 Year Florida Exposure Data for UV/EB

Gloss Retention

The initial 60° gloss values for all of the UCECOAT formulations were between 89 and 95. The 60° gloss retention after weathering is shown graphically in Figure 2. UCECOAT 7674 and 7689 have no significant gloss deterioration over the course of the weathering test. UCECOAT 7571 also performs well, with 60° gloss retention values of greater than 95% through 2000 hours exposure. UCECOAT 7655 starts to develop some loss of gloss after 1500 hours exposure and the UCECOATs 7699 and 7890 experience significant gloss loss after 1000 hours.

Figure 2. 60° Gloss retention as a function of QUV-A exposure time



While weatherability is often a critical parameter for resin selection, it is rarely the only one. With this in mind some typical properties for the UCECOAT resins is presented in Table 1.

Table 1. Typical properties of UCECOAT resins

Name	Viscosity cP, 25°C	Solids %	pH	Particle Size nm	Tack Free Before Cure	Tg (°C)	Mechanical Properties (DMA)		
							Elongation (%)	Stress at Break (MPa)	Young's Modulus (MPa)
UCECOAT 7571	<200	35	7.0-8.5	<100	Yes	119	4.4	59.8	1850
UCECOAT 7655	<200	35	7.0-8.5	<150	Yes	141	film too brittle		
UCECOAT 7674	<200	35	7.0-8.5	<150	No	85	8.4	30.5	1240
UCECOAT 7689	<200	35	7.0-8.5	<100	Yes	105	9.0	40.5	1210
UCECOAT 7699	<200	35	7.0-8.5	<150	Yes	154	film too brittle		
UCECOAT 7890	<200	35	6.0-8.5	<150	Yes	148	film too brittle		

Conclusion

Several UCECOAT resins exhibit a high degree of gloss retention and excellent resistance to yellowing when exposed to QUV-A accelerated weathering, even without the use of UVAs or HALS.

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