Benefits of Accelerated Weather Testing with Xenon Arc for Printed Plastic Films

For many printers, it is crucial to be able to manufacture printed applications on plastic films that have long lasting predictable outdoor life expectancy. Exposure to heat, cold, UV light, and moisture can damage plastic films leading to color fading, yellowing, surface crazing or cracking, and embrittlement. Many film coaters, like Tekra, have coated films that are designed for and meets the printers’ need of various life expectancies of outdoor exposure that far exceeds the life of a raw film in the same environment. But the million dollar question always is, “How long?” How can a printer give a quick and relatively accurate life expectancy of the finished application outdoors to their customer? The use of accelerated weather testing equipment, such as Xenon Arc, is the answer.

Before we get into how Xenon Arc weather testing works and the benefits of this particular type of test, we must first understand the causes of why plastic films, and the inks printed underneath, degrade and fade.

The “Key Three” Causes of Weather Damage

There are 3 main factors that cause weather damage to plastic films: UV light, heat, and moisture. Any of these factors can cause damage to plastic films on their own, but together they can quickly cause more damage than any one factor alone.

Ultraviolet (UV) Light
Exposure to short wave UV light is the main cause for plastic film degradation and the fading of under printed ink. However, long wave UV light and even visible light can cause damage on their own and accelerated damage when combined with short wave UV light.

Heat
Temperature’s effect on plastic film weathering includes thermal oxidation degradations and accelerating of other weathering reactions. The higher the temperature, the more accelerated these destructive reactions happen, especially in conjunction with UV light.

Moisture
Dew, rain and high humidity are the main causes of moisture damage. Finished applications can remain wet outdoors on average up to 8-12 hours daily because of these three reasons. Rain can cause thermal shock to film. Rain can also cause mechanical erosion to the film. But studies have shown that condensation, in the form of dew, is responsible for the most outdoor wetness. Because dew lasts on material for a long time, it is actually more damaging than rain.
Benefits of Accelerated Weather Testing with Xenon Arc - continued

Real vs. Accelerated Testing

Knowing how the outdoors can have an effect on plastic film and printed inks, what is the best way to test the outdoor longevity of a film? Most experts will agree that the ideal approach is outdoor exposure in the intended service environment. But this is impractical due to time and other logistics. Who wants to do testing in multiple locations in the Midwest United States and wait 7 years to know if your farm tractor printed overlay will meet the 7 year spec your customer is calling out?

The next best test is to do outdoor testing in what is considered benchmark climates of either Florida or Arizona. These two locations provide the “toughest outdoor environments” that your application will see. This relieves much of the logistical nightmare of multiple locations, but you are still left with the lengthy test times.

This leaves you with, and what Tekra considers the best alternative, laboratory accelerated tests. These tests replicate the conditions of UV light, heat, and moisture but in an accelerated time table. Generally you can replicate the effects of weathering in 1/6 the time. There are many types of accelerated weather testing, but the test of choice for Tekra is the Xenon Arc Chamber.

Xenon Arc Chamber Benefits

• Xenon Arc testers are considered the best simulation of full-spectrum sunlight. This includes ultraviolet, visible light and infrared. The Xenon Arc is essentially an attempt to reproduce sunlight itself, from 295 nm - 800 nm.
• The Xenon Arc tester uses filters. The filters reduce unwanted radiation and/or heat. Different types of filters can be used depending on the film type and end use application. These filters allow for varying amounts of short-wave UV, which can significantly affect the speed and type of degradation.
• Xenon Arc systems are equipped with an irradiance control system. This is important because Xenon lamps are inherently less spectrally stable than fluorescent UV lamps. Being able to control this, especially as the lamps age, allows the Xenon Arc to be a reliable and realistic light source.
• Xenon Arc testers have built in moisture simulation. It simulates the effects of moisture through water spray and/or humidity controls. The water spraying system is especially good for simulating the effects of thermal shock or mechanical erosion.
• Built in lamp cooling systems quickly dissipate the excess heat that the lamps produce allowing for quality control of temperature.

When Tekra has their testing done, it is always done with a Xenon Arc Chamber under test method SAE J2527. Tekra tests their outdoor weatherable films for 1000 and 2000 hours. In Tekra’s judgment, it is the best method to test weatherability when consistency, uniformity, and time are of the utmost importance. It is also the easiest way for printers to show the expected outdoor life of the finished application to the end user.
Benefits of Accelerated Weather Testing with Xenon Arc - continued

References
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