

Table 1: UV Source & Process Parameters

At a **minimum**, record the Joules/cm² and Watts/cm². Tracking the applied power and speed/exposure time is also suggested.

| No. | Parameter | Comments |
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| 1 | Applied Power Setting | Increasing the applied electrical power normally increases the power Watts (W/cm ²) of the UV delivered to the cure surface. Understand the settings on the system and the lowest usable setting. Record the W/cm ² . |
| 2 | Belt Speed or Exposure Time | The belt speed/exposure time impacts the amount of energy (J/cm ²) reaching the cure surface. Independently confirm the belt speed. Record the J/cm ² . |
| 3 | Spectral Output | Make sure your UV source(s) can deliver the spectral output needed for the photoinitiator package. If your application requires multiple/different sources, make sure that each source is in the correct position. Not all sources/bulbs are created equal and buy on value. Put purchasing controls in place to ensure you are only getting what is expected. |
| <p><i>Note: Parameters 1 (Watts/cm²), 2 (Joules/cm²) and 3 (Spectral Output) work together to allow the formulation to cure to the desired properties. In simple terms, the Watts provide the ability for the UV photons to penetrate through the coating to provide adhesion. Joules provide the energy for the total cure of the material. The Spectral Output of the source interacts with the photoinitiators in the formulation to help achieve the desired properties. If any of the parameters change significantly, the results desired also may change. It is important to collaborate with both the coating and equipment supplier to optimize the formulation and UV sources for the specific product in use.</i></p> | | |
| 4 | Supplied Electrical Power | The uniformity of electrical power coming into the facility can vary. Brownouts and demand from large users such as data centers can impact supplied power. Determine if someone needs to monitor and/or condition the incoming electrical power. |
| 5 | UV System Optimization | Confirm that the UV system being used is suitable for the process. Is an "available UV system" being used instead of a solution optimized for the process? Confirm that the UV source(s) used deliver the needed power (W/cm ²), energy (J/cm ²) and spectral output. Determine if the system provides or minimizes infrared. |
| 6 | UV Delivery Pattern | Confirm that the UV reaching the cure surface is being delivered (focused, unfocused) as expected. Is the UV uniform across the entire width of the UV source? Is a profiling radiometer needed? Is there anything such as a quartz plate between the UV source and the cure surface? (See Figure 2.) |
| 7 | Cooling | Check to make sure the cooling system is performing as designed and that there is proper air flow. If used, replace the air filters as required. High-power LED systems may use chillers. |
| 8 | Maintenance | <p>Establish a maintenance schedule for inspections and preventative maintenance. The frequency will depend on the conditions of the process and the equipment. Be sure to have the necessary maintenance items available. Maintenance can include:</p> <ul style="list-style-type: none"> • Routine Maintenance: Cleaning of reflectors, quartz plates, air filters, bulbs, inspection and adjustment of all equipment • Regular Maintenance: Replacement of bulbs, reflectors, power supply components, quartz plates, air filters and any other consumable items such as RF screens/magnetrons. |
| 9 | Process Window | <p>What are the process conditions that maximize yield and minimize scrap? Were these identified when the process was developed? Risks include:</p> <ul style="list-style-type: none"> • Wait until there is an issue to define your process window. • Failure to monitor the process and catch potential issues • Having a tight process window that is tough to maintain <p>Consistent and regular tracking of your parameters is key. Whatever method is used (spreadsheet, clipboard, profiler files), be consistent collecting and recording the data.</p> |
| 10 | Training | Utilize suppliers and their training programs and websites for information. Incorporate this information and the "tribal knowledge" of key employees in a training program on the UV process, equipment operation and maintenance for the employees. |

Table 2: UV Instrument Selection

Select a measurement solution matched to your application and process. Use consistent data collection techniques and follow the manufacturer's guidelines for handling, cleaning and the instrument for the best results.

| No. | Parameter | Comments |
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| 1 | Physical Size | Select an instrument that will physically work/fit into the process. |
| 2 | Band(s)/Spectral Response | <p>The spectral response of an instrument is determined by the manufacturer.</p> <ul style="list-style-type: none"> • Instruments with a single or four-band response are available. • Select the band based on the source type, photoinitiator package and desired final product properties. • An instrument designed for broadband (mercury) sources may not provide accurate values for an LED. • If surface properties (scratch or stain resistance) are important, monitoring UVC in addition to UVA is important. • Instruments are a communication tool and using the same instrument response as others in the supply chain allows users to communicate effectively. |
| 3 | Dynamic Range | Dynamic range refers to the range of irradiance values that an instrument is optimized to measure. Use the correct range unit for accurate values. |
| 4 | Sample Rate | How fast is the line running? Confirm that the instrument has an adequate sample rate to capture the peak intensity and associated irradiance profile. |
| 5 | Temperature | UV sources generate visible and infrared energy, which can be helpful in some applications. Most UV instruments can be exposed to the intense UV for <u>short periods</u> of time without damaging the optics and/or electronics. Extended UV exposures and/or running the instrument through a thermal oven or infrared system are not recommended and can quickly damage the instrument. Understand the limitations of the instrument to avoid damaging it. |
| 6 | Physical Damage | Manufacturers work to make durable, long-lasting instruments. Customers continue to find creative and new ways to physically damage (abuse) instruments. Please treat the radiometer as an electro-optic instrument and not an indestructible "hockey puck." (See Figure 3.) |
| 7 | Maintenance & Calibration | Follow the manufacturer's guidelines for calibration, handling, storage and cleaning of the instrument optics. |
| 8 | Service | UV, visible and infrared energy can be tough on an instrument. Follow the manufacturer's guidelines for regular service and calibration. |
| 9 | Expectations | <p>Have realistic expectations:</p> <ul style="list-style-type: none"> • Understand the instrument and its spectral response • Don't set the process window tighter than the instrument's stated performance • Keep the instrument calibrated |
| 10 | Instrument Settings, Data Techniques | Use the same instrument settings, data collection and recording in all company facilities. |