An Integrated UV Curing Strategy for Medical Device Manufacturers

Digital Light Lab

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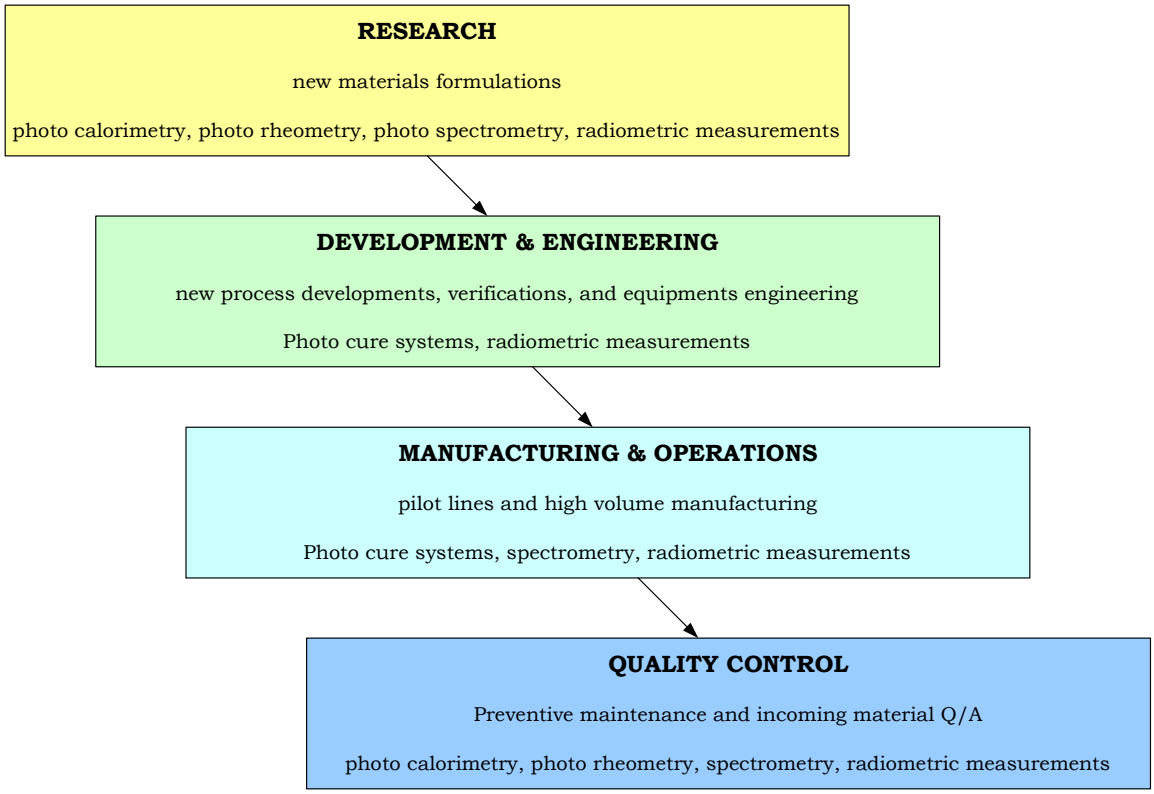
Digital Light Lab provides an integrated set of light delivery systems and measurement instruments suitable for various photo-curing applications. Our systems and instruments provide a unique platform where various photo-curing activities can be seamlessly integrated. Our instruments are specifically designed to assist research scientist during material formulation, engineers for process developments, manufacturing engineers for equipment manufacturing, and operational personnel for high reliability and performance during the manufacturing operations.



Research– Material scientists and chemists are faced with ever increasing challenges of researching and formulating new materials. They usually depend on various techniques such as thermal analysis, rheology, and spectroscopy techniques. The researchers in the area of photo cure are faced with even additional challenges associated with light generation and measurements with respect to their cure research and material formulations. There are a number of analytical instruments marketed toward these widely practiced techniques. However, most of these analytical instruments such as Differential Scanning Calorimeter (DSC), Rheometers, and Fourier Transform IR spectrometers

(FTIR) does not provide an adequate support for the photo cure research. Specifically, these instruments lack accurate and precise light generation (wavelength, intensity, and duration) and measurements. Therefore, the researchers have to create their own light source and/or deal with non-adequate supplied light by these instruments.

Digital Light Lab has developed an innovative patented pending Photo Cure Modules that can easily be added to the commercially off the shelf DSCs, Rheometers, and FTIRs. These modules deliver precisely tuned wavelengths and optical intensities to your material under investigation. With our modular Photo Cure Modules, scientists and technicians have the flexibility to deliver the intensity and wavelength of UV and visible necessary to repeatedly evaluate, fine tune, and troubleshoot their new materials research. These modules allow the scientist to easily set the intensity, duration, and wavelength of interest while exploring the solution space. Therefore, they can focus more on the material research and less on the light generation and measurements.

Development & Engineering– Once the new material formulation is completed, a photo-cure manufacturing process has to be developed, characterized, and validated. Process engineers usually work with the material scientists and/or chemists to develop and quantify such process. Historically, there has been a disconnect between the scientist and the process engineers. This has been mainly due to lack of understanding of light measurement techniques and equipments. For example, the scientist may use a broadband light source with optical filters to initiate the photo cure process during their research phase. They usually characterize the light source in terms of wavelength and intensity. Such characterization usually requires accurate understanding of the light source spectra, filter spectra, radiometer spectra, and the radiometer calibration method. While these are simple engineering measurements, the scientists are not usually trained and/or have the right equipment to perform these measurements. Therefore they may not characterize and communicate their process to the process engineers correctly. For example, researcher may use a general-purpose radiometer with broadband spectral response, which may be calibrated at wavelength λ_1 whereas the photo initiator may be sensitive to wavelength λ_2. Therefore, the radiometric measurements are not true photo cure process parameters. This problem may even get more complicated as the process engineers may even use different radiometers with different spectral response and calibration to establish and validate the photo cure process.

Digital Light Lab has developed a family of light delivery systems based on its PhotoCure technology. These systems provide an accurate, precise light generation, delivery, and measurement to the material under test. The process engineers can easily configure these systems to prototype, characterize, and validate their photo cure process. For example, these systems can configured for different special topology, and can be programmed for specific intensity, duration at user defined wavelengths. These systems also incorporate internal radiometers that constantly measures and corrects the light outputs to minimize any drift. These systems are inherently compatible with the Photo Cure Modules that are used during the material formulation and research. This empowers the researchers to easily communicate their photo cure process parameters to the process engineers and thus reduce any delays due to miscommunication and mismeasurements.

Manufacturing & Operations – Photo-cure manufacturing equipments are usually designed based on the developed process and other manufacturing requirements. Once again, the manufacturing equipment designers have to work closely with the process engineers (or possibly the material scientist) to make sure that manufacturing equipments are designed, built, installed, and operating properly. Ideally, the manufacturing designers would like to use the same photo cure system that is used by the scientist and the process engineers. However, other manufacturing requirements such as such installations, manufacturing throughput, and maintenance issues may not allow that.

Digital Light Lab provides accurate. photo-curing systems suited for the manufacturing environments. Whether it is a pilot line operation or a high volume manufacturing line, our modular photo-curing system can be easily configured for your applications. Our system contain all the necessary subsystems required such as the power supply, controller, light engines, thermal managements, optics, built-in radiometer, and PLC interface. This modular approach empowers the manufacturing equipment designers to focus more on the integration of photo-cure system into their manufacturing line rather than building a photo-cure systems. Weather your needs are for UV or visible light, we have the experience in creating rugged light sources in virtually any physical dimensions necessary to fit your manufacturing line. By utilizing our modular building blocks, we can create custom photo cure systems utilizing the same robust technology used in R&D with a low cost per unit

Manufacturing & Operations Support: Digital Light Lab also provides several measurements instruments to support the photo-cure manufacturing activities. These instruments are developed to minimize down time, increase yield, and maintain product performance over the course of the manufacturing. Our instruments provide radiometric, spectroscopic, and thermal measurement of your photo-cure manufacturing line. They are great tools to verify a new installation and compare to an existing installation else where in the same or remote locations. They can also be used to diagnose photo-cure related problems associated with the intensity, wavelength, and dosage. Some photo-cure based manufacturers use them as a preventive maintenance tool routinely to avoid long down time and sustain a good yield.

Furthermore, by employing our photo-DSC or Photo-Rheometers or Photo-FTIR modules, the quality assurance personnel can verify the incoming raw material to the specs developed during the formulation phase using the same equipments. This increases the quality of the product as they are conforming to the process set by the R&D personnel.