

Arc and Microwave Terminology

Updated January 26, 2019

additive bulb (lamp) – mercury bulb (lamp) containing metal additives such as iron, gallium, indium, tin, or others. These bulbs (lamps) produce variations in spectral output with a mercury only bulb (lamp) as the reference.

arc length – distance measured between the electrodes in a quartz bulb (lamp). See effective cure length.

ballast – an inductive transformer device that stabilizes the amount of current flowing through the bulb (lamp) so that the power output remains constant.

borosilicate – strong, heat-resistant, colorless, silica glass that contains a minimum of five percent boric oxide, exhibits exceptional thermal shock resistance, and transmits a greater percentage of ultraviolet energy than glass. Common material used for plates, reflectors, lenses, and other optics.

bulb (lamp) – sealed quartz tube containing a mixture of inert gas and mercury under medium pressure. Electrode bulbs (lamps) are fitted with electrical connections at the ends of the bulb (lamp). Microwave bulbs (lamps) contain no electrical connections. The mercury and inert gas are energized (vaporized) by either a voltage arc or microwave energy. The vaporized plasma emits UV light.

burn-in-period – second stage of the start-up process of a UV bulb (lamp) and is the total time it takes the current and voltage inside the bulb to stabilize during start-up.

capacitor – corrects the power factor in the main power supply to reduce current levels in the UV system.

cold mirror – reflector that is coated with a dichroic material that absorbs or passes wavelengths in the infrared range while reflecting those in the UV range. See dichroic.

cassette (cartridge, cradle) – supports the UV bulb (lamp) and reflector inside the lamp housing. Typically a removeable assembly allowing for easier maintenance.

cure length – see effective cure length.

dichroic – a coating designed to pass or absorb certain wavelengths and reflect other wavelengths. In UV lamp heads, dichroics are used on reflectors to pass infrared energy and reflect UV energy.

devitrification – act of making quartz glass opaque through prolonged heating and UV exposure.

doped bulb – see additive bulb.

effective cure length – length of a bulb (lamp) that delivers optimal UV output. For electrode bulbs (lamps), the effective cure length is always less than the arc length. For microwave bulbs (lamps), the effective cure length is the length of the bulb (lamp).

electrode – electrical fitting at the ends of an arc lamp (bulb). The electrode consists of a tungsten pin surrounded by a tungsten coil and is used to maintain a voltage arc across the bulb (lamp). Electrode is also used to refer to the style of bulb or system when differentiating between microwave and electrode bulbs and microwave and electrode systems.

electrodeless – a microwave powered UV system. Refers to the fact that microwave bulbs (lamps) do not have electrodes.

flood – an unfocused band of UV light that is more evenly distributed across the width of a reflector. To generate the flood, lamp heads use a parabolic reflector instead of an elliptical reflector.

focal distance (length) – perpendicular distance from the edge of the lamp head to the point where the UV light emitting from the bulb (lamp) converges. This is the location of maximum UV concentration. Only applies to arc and microwave systems. Not LEDs.

focus – line external to the lamp head where the UV energy reflected from the lamp head is at its highest concentration. Only applies to arc and microwave systems. Not LEDs.

gallium – a bluish white metallic element used in additive mercury bulbs (lamps). The gallium additive provides a yellowish tint to an unenergized UV bulb and a violet coloration to the UV output. Gallium bulbs have a spectral peak around 417 nm and a spectral concentration between 400 and 450 nm. They are often used when deeper cure is required or with white formulations containing titanium oxides. In some industries, microwave gallium bulbs are referred to as V bulbs.

igniter – see starter.

indium – silver white metallic element used in additive mercury bulbs (lamps). The indium additive provides a yellowish tint to an unenergized UV bulb and a violet coloration to the UV output. Indium is used to shift the spectral output past 400 nm. In some industries, microwave indium bulbs are referred to as Q bulbs.

integral blower – refers to the system cooling fan when it is mounted directly on the lamp head.

integral shutter – a shutter assembly that is built into the lamp head. Common designs include a pneumatically actuated clam shell that blocks the light when closed and acts as a reflector when open and a pneumatic slide mechanism that moves the lamp head behind an internal louver when shuttered.

irradiator – see lamp head.

lamp – see bulb.

lamp head – assembly containing a housing, UV bulb, and integral or remote cooling fan. An electrode system often contains a removable cassette subassembly while a microwave system contains magnetrons, a cavity, and an RF screen.

liquid chiller or cooler – cooling system used with some arc lamp systems. It circulates coolant through the lamp housing and quartz filter if used.

louver – part of a UV shutter system or shielding section that blocks UV light while allowing cooling air to pass through.

magnetron – assembly contained inside a microwave lamp head that converts high voltage electrical input into RF energy.

mercury – a silver-white metallic element that is liquid at room temperature and is used to create a vaporized, UV-emitting plasma gas inside a quartz tube when it is energized through the use of either a voltage arc or microwave energy. When energized the bulb produces a bright white UV output. Mercury bulbs have a peak spectral output around 365 nm and a concentration around 254 nm. In some industries, microwave mercury bulbs are often referred to as H bulbs.

mercury arc – electric discharge passed between two electrodes and through a mercury vapor medium inside a quartz tube.

mercury plus (H+) – refers to microwave bulbs (lamps) that contain additional mercury. Mercury plus bulbs are only available in microwave lamps.

metal halide – see additive bulb (lamp).

microwave – part of the electromagnetic spectrum between one millimeter and one meter. These wavelengths are longer than infrared waves and shorter than radio waves.

negative cooling – when cooling air for a lamp head is drawn from the area surrounding the substrate or part being cured through the lamp head. Negative cooling also provides exhaust for the UV system if it is ducted away from the press and/or out of the facility. Negative cooling is most often supplied with a remotely installed cooling fan (blower).

out of focus – when a lamp head is located further away from the substrate or closer to the substrate than the focal distance. An out of focus lamp delivers less irradiance to the cure surface than when the substrate is located at the focus.

ozone (O₃) – unstable, colorless gas with a penetrating odor that is generated by the reaction of short-wavelength UV light typically in the range of 160 to 240 nm.

ozone inhibiting (ozone free bulbs) – bulbs (lamps) where the quartz is manufactured with an additive that prevents the transmission of shorter UV wavelengths.

planar shutter – shutter assembly that is externally attached to a lamp head. The louvered shutter moves perpendicular to the emitted UV light.

positive cooling – when cooling air for a lamp head is blown into and through the lamp head. Positive cooling can be supplied through either an external blower ducted to the assembly or through an integral blower or fan mounted within or on the assembly. With positive cooling, an additional exhaust system is required to remove heat and ozone.

quartz plate – plates made from quartz or borosilicate that allow UV energy to penetrate with minimal loss in irradiance and are mounted in front of the lamp head. The plates are used to prevent positive cooling air and

air-borne contaminants from contacting the substrate or part, negative cooling air from contaminating the bulb and reflectors, or to remove some of the heat that is radiated from the UV bulb (lamp). If the goal is to reduce the amount of heat contacting the substrate, additional cooling air must be blown across the quartz. If additional cooling air is not used, the quartz will eventually heat-up and begin radiating heat onto the substrate. To further reduce heat, the quartz can be coated with a material that passes UV light and absorbs infrared energy.

quartz tube – (1) a sealed tube made from a silicate material that is filled with a precise mixture of mercury and various inert gases and sometimes fitted with electrical connections. The vaporized mercury emits light when it is energized through the use of either a voltage arc or microwave energy. Often used to refer to the bulb (lamp). (2) an open tube made from a silicate material. The tube is placed in front of a UV lamp head or inside the assembly and flooded internally with nitrogen. Parts traveling through the tube, such as fiber optics, are safeguarded from exposure to air and ozone in order to improve cure. (3) an open tube made from a silicate material. The tube is placed in front of a UV lamp head and flooded internally with distilled water. The water absorbs infrared energy from the bulb (lamp) and carries it away from the press environment. Also known as a quartz filter.

reflector – reflects and concentrates the UV light onto the substrate or part. Rolled from highly polished aluminum sheet metal or formed from borosilicate into elliptical or parabolic profiles. Elliptical profiles optimize the concentration of UV energy that is reflected off the bulb (lamp) by guiding the radiation into a tightly focused UV band. A parabolic reflector results in a flood of UV light. Holes or slots in the reflector allow cooling air to pass through the reflector to the bulb (lamp). The holes or slots are engineered for size and location to provide both optimal and balanced airflow across the length of the bulb.

remote blower – refers to the system cooling fan when it is mounted separate from the lamp head and ducted into the lamp head assembly.

RF – radio frequency. Any frequency between normally audible sound waves and the infrared light portion of the spectrum lying between 10 KHz and 1,000,000 MHz. Used to vaporize the mercury in microwave bulbs (lamps).

RF detector – monitors RF levels in the vicinity of the UV system and signals the power supply to switch off the UV if RF levels exceed allowable limits.

screen – a wire mesh assembly attached to a microwave lamp head that allows UV to pass through but prevents RF from leaking outside the unit.

shutter – an assembly designed to block UV light emitted from a lamp head while simultaneously allowing the flow of cooling air.

solarization – effect of UV light on a quartz bulb (lamp). Over time, UV light and heat will cause the quartz to devitrify or revert back to its crystalline and cloudy state.

solid-state electronics – circuits or devices built entirely from solid materials and no moving parts.

starter – used in electrode, ballast-based systems to vaporize the mercury at start-up. Applies a several thousand-volt potential across the bulb during start-up. An internal circuit discontinues the potential when current is established across the bulb (lamp).

starter bulb – used in the start-up of a microwave system to ignite the mercury vapor in the bulb.

static exposure – exposure to a constant irradiance over a controlled time period.

striking – initiating the start-up process when the mercury in the bulb (lamp) is first vaporized.

vittrification – act of changing pure opaque quartz into glass through fusion.

waveguide – directs microwaves toward the bulb (lamp) in microwave systems.