DDC NEWSLETTER

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The information presented in this newsletter continues from the Spring 2002 issue and is part of an article on Projection lamps (article by Bob Donofrio and Bob Eckel

Lamp Characteristics Needed for Projection

The listing of the five most important lamp characteristics is somewhat controversial and we have chosen the following from a list mentioned by Brennesholtz (ref. 5.). They are; 1. Life time, 2. Cost, 3. Efficacy, 4. Source size, 5. Source color. 6.instant (or almost instant) on, 7. No-emission lines 470nm-510nm or 570nm-600 nm, 8. Safe and simple power supply.

From the lamp spectral emission, we see that, Metal Halide, Xenon and Hg lamps all show some form of line spectra so that this no-line criteria is hard to meet except for incandescent tungsten. Carbon arc lamps show cyanogen band maxima (ref. 7) around 380 nm & 250 nm. But, the first five or six items would be pluses in a projection lamp. We will now look at some of these features in more detail.

Lamp Life and Failure Modes

A goal for lamp "Lifetime" is 5,000hrs. Normal lamp life is 2000hrs or better.
Some of the factors that effect lamp life are seen in the Table 2 below;

Lamp Life Factors	
1	Cathode Sputtering
2	Anode Evaporation
3	Envelope Darkening
4	Quartz Cracking
5	Devitrification
6	Solarization
7	Processing
8	Electrode Moly Ribbon Temp

Table 2 - Lamp Life Factors

These lamp life factors are somewhat interrelated but during the operation of an arc lamp the cathode material is sputtered and the anode material is evaporated on the inside of the quartz envelope. This causes the darkening of the envelope. Stress either through shocks or thermally causes the quartz to crack. Devitrification, which is the transformation from the vitreous state of quartz to the crystalline state. This appears as a cloudy region in the quartz. If this region is in the optical path then it causes the radiation from the lamp to be scattered and to increase the effective size of the source radiation. Processing of the lamp is a proprietary issue but for example, the cleaning of the electrodes before being used in the lamp is known to improve performance through the reduction of outgassing. Lamp lifetime is determined by the failure mode. Generally, during the operation of an arc lamp the tungsten from the anode is removed via the bombardment from the plasma's electrons. (In some high current cases the anode is seen to be eroded due to surface heating by the cathodic electron jet) The tungsten is deposited on the inside of the bulb (or bubble) and reduces the transmission of the radiation from the lamp. A criterion is that when the lamp intensity is reduced to 70% of its initial value, it should be replaced and this is considered the life of the lamp. Another aspect of the lamp life is quartz cracking. This can occur if there is a sharp thermal gradient on the quartz housing which gives rise to devitrification on cooling and local stress in the quartz housing. Although the geometry changes via larger quartz surface area can reduce this lamp aging, it has been found that good lamp fabrication methods can give improved life without the increased surface area. Recent Philips UHP lamps have stated lamp life of 10,000 hrs