

DDC NEWSLETTER

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

Efficacy - Arc lengths and Projectors

Efficacy is the efficiency in Lumens per watt conversion of electrical power into visible light. Luminance, is the amount of visible light a source emits per unit solid angle, per unit area of the source. The delivered screen Luminance (lumens) is, determined by the product of the average luminance of the source collection optics, the transmission of the optics and the entendue of the system. Where (from ref 5) the entendue = $(\pi \times A_{(slm)}) / (4 \times f / \#^2)$ and where $A_{(slm)}$ = the area of the spatial light modulator. Thus, the $A_{(slm)}$ and the $f \#$ limit are factors which determine the light delivered to the screen. 1000 screen Lumens is generally accepted as the value required for comfortable viewing (with room lights on). Thus with the typical entendue a high intensity arc lamp is needed. This is satisfied by 200W arc lamps with arc gaps from 1-3 mm. Shorter arc gaps generally reduce lamp lifetime. Welsh Allyn has stated (ref 6) that the relation between arc length (L) and the diagonal of the light valve or scanning engine (D) and the $f \#$ of the projection optics is $L = 5.51D / f \#$. Thus for a 4:3 aspect ration and a 0.75" (19mm) light valve and a F/3.5 lens the optimum arc length is near 1.2mm.

Lamp and Lamp System Structures

High Power arc lamps consist of an envelope, electrodes, seals and fill.

Envelope Materials

The envelope of a lamp should be transparent to the emitted radiation, impervious to air, or fill gas and mechanically strong. A list of possible

envelope materials is seen in Table 3 (ref 14) below.

Envelope Material	Short Cut off Wavelength (nm)
Sapphire	142
Suprasil Quartz	160
Clear Fused Quartz	220
Ti Doped Quartz	250
Ce Doped Quartz	380

Table 3 Possible Envelope Material

Please note that the cut-off wavelength is that wavelength in the radiation spectrum below which, no radiation is observed emanating from the lamp. For low power use a hard glass or Pyrex (softening point about 600 deg. C) is used. The low power applications would be signal beacons, low power lamps, low power stroboscopes, low power photographic applications, camera flash guns. Quartz is used for high power conditions. There are a number of different types of quartz; clear fused silica or vitreous silica types which can stand high pressures and high thermal loading. Synthetic Quartz or Suprasil Quartz has high purity. It is a man made quartz, with a transmission cut off at 160 nm. It is free from solarization expensive and the least available. Next we have Clear Fused Quartz (The CFQ material is usually used for Hg Lamps). Clear fused quartz has a softening point 1300 deg C. It has an operational limit to 900 deg C and a UV cut off about 220 nm. The CFQ solarizes (where solarization is the formation of color centers giving a purple color due to presence of Fe, Al, Ge & other rare earth materials). (to be continued)

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