CLEARING RADIATION DARKENED TV LENSES

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Summary

The TV lenses used in high radiation areas here at the Zero Gradient Synchrotron (ZGS) become very brown and totally unusable within a short period of time. A method has been found whereby rotation of lenses from this area to exposure by UV light can keep a constant supply of usable lenses in service. Tests were also conducted on ZGS TV viewing ports to determine the clearing effect of UV on 3/4-in, 1-in, and 4-in-thick plate glass.

Introduction

The UV light can be used to clear brown irradiated TV lenses and standard plate glass. All irradiated items were browned here at the ZGS by proximity to a high radiation field, except for the 1/8-in and 1/4-in glass plates. They were browned by exposure to a gamma source and received a dose of 10^8 R. These plates were used to determine the best wavelength and to evaluate the efficiency of the various UV sources. The various UV sources were: 15-W black light fluorescents, 100-W IJV spotlight, 275-W sunlamp, 400-W mercury-vapor street light, 2.5-kW xenon lamp, and an 18-mW helium cadmium laser. It was found that clearing time increases with glass thickness and decreases with IJV intensity. Several tests were also conducted on 1-in-thick plate glass using different UV sources.

Determining Best Wavelength

With the use of a 2.5 kW xenon source monochromator, half of the nine 1/8-in glass plates were exposed to 5,000 ergs/mm^2 of UV for 20 min. The wavelength was varied for each plate and the results can be seen on Fig. 1.

The 3400 Å area appears to do the best clearing, and since mercury-vapor lamps have a peak at 3650 Å, this was the source used for all TV lens and glass plate clearing. Several tests were conducted using various sources of shorter wave UV, but these sources had little clearing effect.

UV Used to Clear TV Lenses

There are several ways to keep clear TV lenses in service—the easiest is a constant supply of new lenses, which can be quite expensive. Another is to completely disassemble the lens assembly into its individual lens elements, and bake in an oven until clear. One of these lens elements is an achromatic lens (two lenses cemented together). If heated while still cemented, the cement will bubble or blacken, rendering the achromat useless until dismantled and cleaned. The method that requires the least amount of work and cost, but requires the longest time, is exposure of the complete lens assembly to longwave UV. Several different radiators can be used to clear TV lenses but all have one problem, and that is the removal of IR. If the IR is allowed to heat the assembly, damage to the achromatic lens may result. This method uses a fan for cooling and four F15T8BL black light fluorescent lamps. (See Fig. 2)

The main advantage of this method is several lenses can be cleared at the same time. The life of the lamps is very long—these have been running about 4 years. The upper lamp fixture is movable and is lowered until one of the lamps is adjacent to most of the lens openings. It is imperative that the UV from the lamp passes through the lens. The intensity of this source as measured on a Blak-Ray UV meter is 180 ergs/mm^2 at 1 in, in contrast with a standard 15 W white fluorescent lamp of only 7 ergs/mm^2 at 1 in.

Due to the high IR in this next method, the closest the zoom lens could be to the source was 5 1/2 in.

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even with the fan. (See Fig. 3) The lamp is a 275-W R. S. General Electric Sunlamp.

![Fig. 3](image)

The UV intensity at 5 1/2 in was 500 ergs/mm². This is somewhat higher than the fluorescent lamp, but has the disadvantages of short life and can clear only a few lenses at one time.

The next UV source was the 400-W mercury-vapor street light. Although only a few lenses can be cleared at one time, the main advantages are long life, high UV output (300 ergs/mm² at 6 in) with low IR.

One method which I haven't tested is the 100 W UV spotlight; it has long life, high UV, and relatively low cost and should work very well on individual lenses.

**UV Used to Clear Plate Glass**

Several sources of UV were tried on a 1 in x 12 in x 24 in irradiated glass plate window. (See Fig. 4)

![Fig. 4](image)

In the above figure, the UV source on the left is a 275-W sunlamp which had a piece of aluminum foil placed in the exposure area to contrast the clearing effect. Center is the 15-W fluorescent lamp, and the spot on the right is a 100 W UV spotlight. All areas were exposed for the same period of time, about 4 months.

Another test using the 275-W sunlamp with a moving water filter, which is used to remove IR, involved the use of a 1/4-in glass plate located 3 in from the lamp with the filter between. On a spectrophotometer, prior to installation, the plate had a 7.5% light transmission at 5000 A. The UV intensity was 1500 ergs/mm², and after only 5 hours, the light transmission had changed to 38%, 10 hours to 54%, 50 hours to 80%, and 480 hours to 88% with 92% representing clear glass.

The 400-W mercury-vapor street light was used as the UV source for clearing a 4 in x 4 in x 4 in block of cave window glass. The block was placed 3 in from the source, with an intensity of 600 ergs/mm². The exposed side was covered with aluminum foil with a 1 in hole in the middle. Clearing could easily be seen from the side. As days passed, the clearing hole extended further and further into the block.

The next source, with the highest intensity, was a helium cadmium laser with a 2-mm diameter beam and an output of 18 mW or 180,000 ergs/s. A 1/8-in glass plate was used and exposed for different lengths of time (see Fig. 5).

![Fig. 5](image)

Figure 5 shows that the laser, being the most intense UV source, requires the least amount of time to do the clearing.

838