UNIVERSITY OF CALIFORNIA OBSERVATORIES

LICK OBSERVATORY TECHNICAL REPORTS

No. 89

CLEANING PROCEDURE FOR SOLGEL COATED OPTICS IN THE 120" TELESCOPE PRIMARY FOCUS CORRECTOR

W.E. Brown, E. James, V. Wallace

Santa Cruz, California
February 23, 1999

Cleaning Procedure for Solgel Coated Optics in the 120" Primary Focus Corrector

W.E. Brown, E. James, V. Wallace

University of California Observatories/Lick Observatory
University of California, Santa Cruz CA 95064

UCO/Lick Observatory Technical Report No. xx

February 23, 1999

ABSTRACT

There are five optical elements in the 120" telescope primary focus corrector: 3 lenses and 2 round prisms. All of these optics were first coated in early 1994 by the coating laboratory at Lawrence Livermore National Laboratory with an anti-reflective coating process known as solgel. These coatings were hardened with an ammonia vapor process. Even so, **these coatings are extremely delicate and cannot be physically touched with any solid object without causing permanent damage**. Therefore, the cleaning of these coatings requires special procedures. This report is intended to be a "cookbook" for this procedure.

1. INTRODUCTION

The primary focus corrector was in service for nearly five years (until February 1999) before any cleanings were attempted, other than minor dusting with compressed nitrogen gas. At that time, Bill Brown contacted the specialists at Lawrence Livermore for cleaning instructions. Our original plan was to clean only the outer surface of the uppermost lens (lens #3) as it had received the most exposure and was the dirtiest. We had planned to mount the corrector on the top of the telescope and position it towards the horizon, where the corrector can be reached by standing on the platform known as "MOS Landing". This would have eliminated the requirement for disassembling the corrector. However, due to other mechanical maintenance requirements, it was necessary to disassemble the corrector anyway. The upper element was removed using the handling fixtures originally designed for assembling the corrector in 1994. For a description of the fixtures and the assembly/
disassembly procedures, see the primary focus corrector assembly and alignment procedures in the M.O.S. Engineering Procedures & Calcs Book.

2. REQUIRED EQUIPMENT

I. Optical Handling equipment

A. Handling Sling (drawing # MS036) for element #1.
B. Handling sling (drawing #MS047) for element #2.
C. Handling sling (drawing #MS057) for element #3. Note: handling fixtures do not exist for ADC prisms.
D. Lens removing fixture (drawing #MS1166). This fixture and items in (E) are used for all three lenses, not for the ADC prisms.
E. Lens posts and Supports (drawing #MS1167 –1 & -2). 3 each required.
F. 3/8" diameter lifting eyes and lifting straps: 3 each (1/2" diameter lifting eyes for barrels.)
G. SAE hex key set and slotted screwdriver.

II. Cleaning Equipment

A. "Sure Shot" Model A pressurized spray can with 12" nozzle extension. Also hose and air chuck for pressurizing.
B. 190 proof ethanol. One gallon should be sufficient.
C. "Texwipes" TX1109 cleanroom wipes.
D. Cleanroom swabs.
E. Large tray to catch ethanol during wash.
F. Powder-free cleanroom latex gloves.
G. Hair dryer.
H. High Intensity lamps.
I. High purity dry nitrogen gas with filtered nozzle and hose.
J. Vinyl adhesive tape.
K. Vacuum cleaner with a HEPA filter.

3. PROCEDURE

The first process is simply to blow off any loose material particles with the dry nitrogen, collecting the ejected particles with the vacuum. Take special care not to touch the coated surface with either the nozzle or the vacuum.

In general, the method for safely cleaning solgel coatings is to use a pressurized spray of pure ethanol. 190 proof ethanol was used instead of ultrapure 200 proof because benzene is frequently used to remove the remaining water and this was unnecessary for this application. **CAUTION – 190 proof ethanol is extremely flammable. Avoid spraying on or near hot surfaces, in the presence of electrical discharges, or in a confined space. Use with adequate ventilation!**

The "Sure Shot" spay gun is filled approximately one-half full with ethanol and pressurized with dry nitrogen to about 20 psi. The optical element was held vertically in its handling fixture and suspended over a tray to collect residual ethanol. At this point a shield was placed around the top third of the lens, from the element edge back over the

rear surface to prevent over-spray from migrating over the top and depositing on the back side. This shield was made from notepaper but a more substantial shield should be made from thin gauge aluminum for future cleanings.

Using back and forth horizontal motions, ethanol is sprayed on the optical element from top to bottom. Use enough ethanol to dislodge and remove any adhering particles down into the tray. If ethanol is allowed to evaporate naturally, a non-uniform film is left behind on the optic. Therefore, using the same motion, warm (not hot) air from the air dryer evaporates the ethanol keeping a "wet edge" ahead of drying. The above procedure of washing and drying can be repeated several times as needed without adverse effects in order to dislodge stubborn particles.

After the final cleaning of the first surface, the shield can be repositioned and the procedure repeated for the second surface as needed.

4. CONCLUSION

Because solgel coatings will naturally degrade with time, adverse environmental conditions, and handling mishaps, there will likely be some permanent degradation. However, the surface should be visibly improved.

Upon inspection of the remaining elements, it was decided that they were not dirty enough to risk removal from the corrector barrel. These elements, rather than being washed with the ethanol, were cleaned in situ by using dry nitrogen with the filtered nozzle, and the vacuum cleaner. The results were good enough to refrain from disturbing them any further at that time.