Cleaning and Protecting Large Mirrors Using a Polymer Solution

Polymer cleaning solution eliminates residue on optical surfaces.

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Cleaning and protecting optics is a challenge — contamination must be removed without damaging the surface. Preventing recontamination for extended periods of time after cleaning was unattainable prior to use of polymer strip coat films. The SLRSC Western Range Depot Optics Group, WRDOG, at Vandenberg Air Force Base, is a pioneer in the cleaning and protection of precision glass optics, lenses, and large mirrors using polymer solution technology.

The **Polymer Solution is Applied** to a 36" telescope with the mirror in its operating position inside the telescope.

The WRDOG staff protects **Mirrors and Corrector Plates** with the polymer solution. Clean components from several telescopes are protected from recontamination while waiting for telescope assembly. Technicians may work without gloves until the film is removed after the mirror is placed in the telescope.

Contaminants on optical surfaces cause problems ranging from moderate to severe performance degradation to catastrophic destruction. Traditional optical cleaning is a mixture of art and science requiring good technique in combination with high-purity solvents for satisfactory results. Since airborne contaminants immediately begin to re-contaminate the optical surface when the cleaning process stops, traditional cleaning methods (such as drag wiping or CO_2 snow) require significant effort to prevent recontamination during the cleaning process.

An ideal optics cleaning process allows treatment of all optics regardless of shape, size, or material composition. An effective cleaning process leaves no residue and removes particulates, oils, fingerprints, etc. from the optic surface. In a more perfect world, a cleaned optic will stay clean up to time of use, regardless of when the cleaning process was performed.

A new polymer solution effectively and safely cleans all glass optics, coated optics, silicon surfaces, sensors, crystals, and first surface mirrors, provided the substrate/coating interface is strong and intact. Cleaning is not recommended for poorly adhered coatings since if the coating/substrate interface is weak or in poor condition, the coating may be removed by any cleaning activity. This caution applies to traditional cleaning methods as well as strip coat cleaning.

The polymer solution has about one-tenth the adhesion to surfaces as standard Scotch tape. A practical application of the polymer in quality control would be its use as an effective optical component Acceptance Test since poor quality coatings or coating imperfections would be revealed when the polymer is removed from a brand new optic.

Just as importantly, the polymer film serves as a protective coating on clean optical surfaces. The polymer film is tough, flexible, and easily removed prior to using the optic. Many studies have shown the polymer film leaves no residue.

The WRDOG is responsible for more than 60 terrestrial and mobile telescopes and in excess of 680 camera lenses of all sizes and types, including some with infrared (IR) optics. As each optic component is cleaned and readied for re-assembly, it is coated anew with the polymer for safe staging until the equipment is prepared for service. The protective polymer film is removed as each component is placed in its correct position in the equipment.

The ability to stage and work with optical components without fear of recontamination allows the WRDOG to work on many telescopes and assemblies concurrently. Work proceeds more quickly because the protective polymer film eliminates the possibility of cleaning the same component several times. The polymer allows cleaning to occur at any time in the refurbishment process, almost without regard for the final assembly timeline. The use of the polymer eliminates the need to construct expensive cleanrooms and allows coated lenses to be left in the open indefinitely.

This work was done by Philip Jackson and Dr. James Hamilton of Photonic Cleaning Technologies; and Steven Elieson of SpaceLift Systems Western Range, Vandenberg Air Force Base. For more information, visit ***http://info.hotims.com/15128-540****.*