Supermirror
Cleaning Guide



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Chapter 1 Introduction

1.1 Intended Use

This document is intended for customers interested in the recommended methods for cleaning Thorlabs' line of supermirrors.

1.2 Explanation of Safety Warnings

⚠CAUTION Caution indicates a hazard with a low level of risk that, if not avoided, could result in minor or moderate injury.

NOTICE Indicates information considered important, but not hazard-related, such as possible damage to the product.

Chapter 2 Cleaning Procedures

2.1 Cleaning Introduction

⚠CAUTION

Flammable/ Volatile Compound Risk
Some of the procedures described in this document require the use of the flammable solvents isopropanol and acetone. Exercise caution when handling these substances. They are also harmful if swallowed or inhaled.

All of Thorlabs' supermirrors are packaged in a Class 1000 cleanroom environment and are shipped in a clean and ready-to-use state. No additional cleaning should be necessary before installation of the optics into the customer's system. However, this document provides detailed instructions for cleaning the mirrors, should it become necessary.

Thorlabs provides two distinct procedures for cleaning. Please read the two procedures to determine the method best suited for your needs and capabilities.

NOTICE

The use of an improper cleaning technique can permanently damage the crystalline coating.

NEVER use optical wipes or other non-shedding or lint-free wipes, tissue paper, towels, or any other object on the coating surface, apart from what is described here. Many of these materials can permanently scratch or damage the coating. The coating should be spray cleaned only, using hand-held spray bottles. If necessary, foam-tipped swabs can be used to clean the optics, more information can be found in the detailed instructions outlined below.

Failure to follow the cleaning protocol will release Thorlabs from any responsibility for any resulting degradation in mirror performance.

2.2 Cleaning Procedure 1: Organic Residue Removal

Thorlabs has achieved the best cleaning results using a solvent-resistant spinner to rotate the optic while spray cleaning (Figure 1).

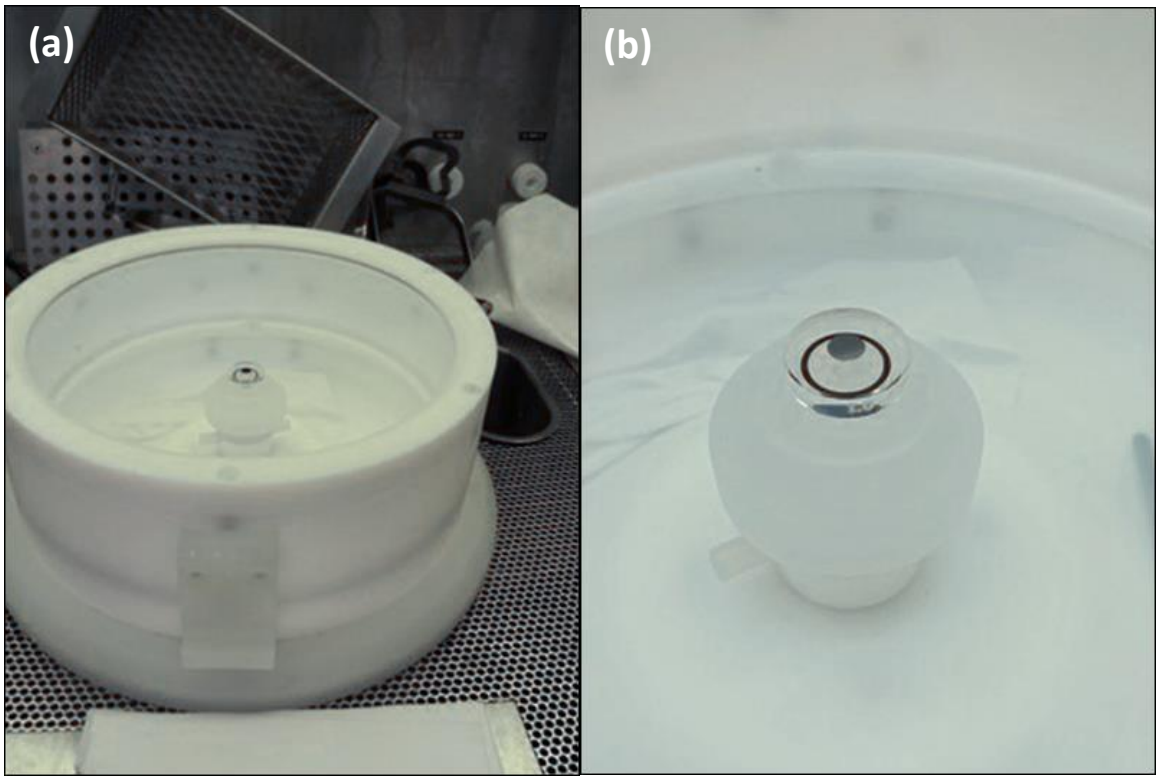


Figure 1 (a) Solvent-Resistant Spinner (b) Detail of Mirror on Solvent-Resistant Spinner

If a solvent-resistant spinner is not available, a crystallizing dish and sieve will act as an effective alternative. Place the optic in the sieve so that any solvents and deionized water (DI) can rinse away without pooling around the optic (Figure 2).



Figure 2 Manual Cleaning Using a Sieve and Crystallizing Dish Instead of Spin Station

It is critical to keep the coating wet during the entire spray cleaning process. Move continuously from one step to the next without drying or allowing the solvent to evaporate.

The procedure for organic residue removal is detailed below.

1. While spinning the sample at <500 RPM (or when placed in the sieve), spray the mirror surface with electronic grade or better acetone (ACE) for 30 seconds.
    - Note: Never allow acetone to dry on the coating. Acetone (and any dissolved organics it contains) can leave a residue on the coating surface if it is allowed to evaporate. Always rinse the mirror surface with isopropanol while still wet following acetone exposure.
2. Next, spray the sample with electronic grade or better isopropanol (IPA) for 30 seconds (Figure 3) to remove the ACE.



Figure 3 Spray Cleaning with Isopropanol

3. Following the IPA step, spray the mirror surface with clean deionized (DI) water for 60 seconds to remove any remaining solvents.
    - Be sure to test the DI water quality before using it. Many facilities have DI water, but, if the system is not maintained properly, contaminants can enter the system and may ultimately be deposited onto the coating. To test the water quality, spray some DI on a clean glass slide and blow it dry. Inspect the slide under a dark field microscope for particles or water spots.
4. To complete the organic removal process, either spin the mirror dry, or blow the mirror surface dry, preferably with clean, dry nitrogen.
    - Be sure to hold the nitrogen nozzle so that it blows straight down onto the coating (Figure 4). Do not sweep the nozzle or water droplets may redeposit onto the coating surface.
    - Do not use canned air or low-grade bottled nitrogen to dry the coating as this can be a significant source of contamination.



Figure 4 Blow Dry with Nitrogen Gun Only at the End of the Entire Cleaning Process

5. Following this procedure, inspect the mirror via dark field or Nomarski microscope for particles, water spots, or other contaminants. If any are detected, please repeat the above cleaning procedure or contact Thorlabs at **techsupport@thorlabs.com.**
6. If available: expose the parts to an oxygen plasma discharge with a 100 - 200 W forward bias for two to three minutes.

2.3 Cleaning Procedure 2: Particulate Removal

Section 2.2 described a cleaning process to remove organic residue from the surface of supermirrors. While this process will also remove most small particles, some stubborn particulate may remain on the surface, which must be removed with extreme care. The cleaning procedure for removal of particulate is detailed below.

Note: this process can be done on spin coater or in a crystallizing dish with a sieve, but it is critical to keep the coating wet during the entire process. Move continuously from one step to the next without allowing the solvent to dry out.

1. Prepare a dilute solution of DI water and optical grade non-ionic surfactant (shown in Figure 5).
    - In this example, we use 3 drops of Tergitol NP-10 (Nonionic) with 500 mL of DI water.



Figure 5 In this example, we combine three drops of Tergitol with 500 mL of clean DI water.

2. Place the optic on a compatible spin chuck (or in a sieve) and spray the optic with the diluted surfactant while spinning at <500 RPM.
3. Next, use a cleanroom grade foam swab to mechanically remove particles off of the coating and substrate surface.
    i. Pre-wet a swab with the diluted surfactant solution.
    ii. While spraying the optic with the diluted surfactant, gently swab the coating from the center outward with the pre-moistened swab (Figure 6).
        - Do not apply any downward pressure on the swab. Simply allow the weight of the swab to sit on the coating as you draw it outward from the center of the mirror to the edge of the substrate.
    iii. Flip the swab over and swipe with the new side from the center of the coating outward as above.
        - Do not wipe with the same face of the swab more than once or you will risk dragging particulates or contaminants picked up by the swab across the coating. In extreme cases these particles may scratch the coating.
        - Do not reuse the swabs. Dispose of all swabs after a single use.

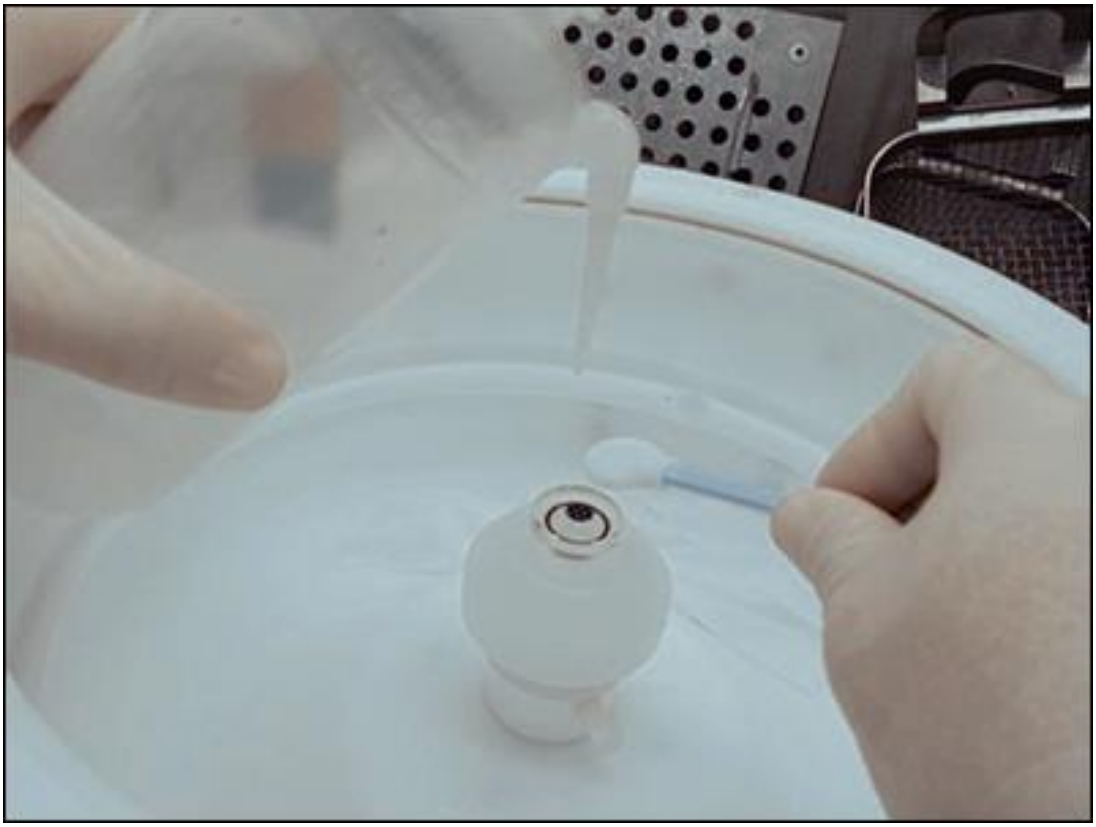


Figure 6 While spinning, swab with the diluted surfactant from the center of coating outward. If cleaning manually, swab from the middle out using 2-3 swabs (replacing after a single swipe of each face of the swab).

4. To remove the diluted surfactant, spray with clean DI water for 60 seconds.
    - As described in the previous section, we recommend that customers test the quality of their deionized water before using it. See Step 3 of Cleaning Procedure 1 for more details.
5. Next, remove any remaining detergent by spraying the sample with electronic grade IPA for 30 seconds.
6. To fully eliminate any residue, spray with electronic grade ACE for 30 seconds.
7. Then spray the optic again with electronic grade IPA for 30 seconds.
8. Blow or spin dry (or both) with clean, dry nitrogen.
    - Hold the nitrogen nozzle directly perpendicular to the coating surface and blow straight down onto the coating. Do not sweep the nozzle or droplets may redeposit onto the coating surface.
    - Do not use canned air or low-grade bottled nitrogen to dry the coating as this can be a significant source of contamination.
9. Following this procedure, inspect the mirror via dark field or Nomarski microscope for particles, water spots, or other contaminants. If any are detected, please repeat the above cleaning procedure or contact Thorlabs at **techsupport@thorlabs.com.**
10. If available: expose the parts to an oxygen plasma discharge with a 100 - 200 W forward bias for two to three minutes.

Chapter 3 Thorlabs Worldwide Contacts

For technical support or sales inquiries, please visit us at www.thorlabs.com/contact for our most up-to-date contact information.



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