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Technical Services Department

Technical Tip

Anti-Reflection Coating Applications on Polycarbonate Lenses

Anti-reflection coatings are the best lens enhancement, which dramatically increase performance. Such coatings can be applied consistently and successfully when attention is paid to processing details. Various types of manufactured equipment will require different procedures. While two identical machines may even require slight formulation variation, there are a few basics to all operations which will promote superior quality to AR coatings. Note all lens enhancements should be completed prior to custom AR process (i.e. engraving, grooving, edge polishing)

LENS SELECTION

Both right and left lenses should be selected as the same type and manufacture. Differences in hard coating technology may provide visual differences in the final AR coating. This would be especially true for lenses requiring tinting.

LENS SURFACING

Surfaced lenses must be clean and defect free. Although some swirls and scratches may be covered with back surface coatings, these defects may become visually apparent after the AR process. All ink markings must be completely removed prior to initial AR process. If utilizing wax/plastic type blocking alloy, pre-clean with isopropyl alcohol, removing all traces of blocking material. Silicones, found in blocking compounds, can create adhesion failure if not totally removed, and can contaminate cleaning baths.

LENS DYEING

All tinting must be completed prior to the AR process. Some loss of pigments within the outer surfaces will be lost during the mechanical cleaning process. Color and transmission shifts can be minimized by dyeing lenses slightly darker than needed, followed by a couple of minutes in hot water, at about 190°F. Lenses requiring color modification to match should be “finished” in the same dye color to assure similar match after the AR process. UV dyes should be only applied minimally, as they lead to coating adhesion failure when applied too heavily.

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PRE-AR CLEANING

Mechanical ultrasonic cleaning typically begins with a soap bath, followed by several rinsing baths. Since every manufactured hard coating has it's own physical properties; we recommend the following guidelines.

- Provide initial cleaning with a cloth and Isopropyl alcohol
- Maintain basic cleaning solutions to a maximum 8.0 to 10.0pH; if acidic tank is used, maintain a 3.0to 4.0pH.
- Ultrasonic power should be adjusted to a moderate power
- Recommended at 60°C, do not allow tanks to heat beyond 65°C
- Monitor DI water supply for purity and resistivity greater than 16 MegOhm/cm.
- Typically minimize lens exposure to each tank to a maximum of 5 minutes, but note individual clean line manufacture's recommendations.
- Change solutions and rinse tanks at least once per week
- Do not physically touch a lens after clean line process.
- All scratches and defects become much more visible after AR application.

PROCESSING WATER

All water use must be absolutely clean and de-ionized. Monitor and provide maintenance frequently.

DEGASSING OVENS

When cleaning is complete, lenses require degassing: removal of dissolved moisture and gasses avoiding bubbles to form under AR layers.

- Maximum temperature of initial oven should be monitored at 60°C
- If storage is needed prior to actual AR process, place lenses in secondary desiccating oven at no more than 40°C.

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AR PROCESS

While the actual deposition of AR layers is typically confidential to a specific company, consistency requires performance criteria to be established and evaluated. Such performance includes reflective color, consistency of color, thickness of each layer, and quality assurance of chemicals, and final performance.

- Provide regular cleaning and machine maintenance. Process variation is a direct result of improper maintenance. Internal equipment cross-contamination effects both appearance and performance.
- Include within each batch a control sample for evaluating designed parameters
- Provide statistical sampling of lenses for assurance of impact resistance. The AR process does effect impact strength.
- Note reflective properties can vary with differences in front curvature or placement within the chamber.

HYDROPHOBIC COATINGS

Patient success with AR coatings has greatly increased with recent technology in providing dirt and moisture repellant properties to the coating. Application of the hydrophobic coating layer plays an important part in the entire coating success. It is recommended that hydrophobic coatings be applied to the outside of the AR coating as a final process prior to final inspection, or last layer on the AR stack.

COATING FAILURES

Troubleshooting coating performance can be simplified while testing samples of each run.

- Samples should be subjected to various forms of adhesion testing. The AR Council offers a complete set of testing protocols. It is up to the AR manufacturer to decide which tests to determine performance verification.
- Adhesion can be related to the underlying hard coating, lens cleanliness, application formula, or equipment condition.
- Crazing can occur on many coatings with extensive processing heat or chemicals. Consistently monitor all stages for adherence to process design.

For any additional technical questions, call the toll-free Technical Services Hotline: (800) 367-2544 ext. 5301
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