COATING PROCESS GUIDE

CHOOSE THE OPTIONS AND PERFORMANCE YOU WANT
WHAT DOES IT TAKE?

HARD COAT + AR STACK + TOP COAT = AR LENSES YOU WANT

The performance and durability of an ophthalmic lens is largely determined by the applied coating package. Satisloh offers a wide variety of durable hard coatings, innovative AR coating stacks, and state-of-the-art top coating solutions. This allows us to meet the needs of every production environment and every customer. The combination of these three components affects cost, process complexity and performance of the coating package and must match lab and customer requirements.

Beyond regular AR coating stacks, customers can select specialty coatings that protect from UV radiation and harmful Blue Light as well as multiple mirror and in-chamber tinting coatings.

No matter which processes are chosen, Satisloh’s expansive knowledge regarding equipment, processes, and matching consumables ensures the ultimate in coating quality.
DECISION #1: HARD COATING

Leading scratch resistance technology.
Choosing the right hard coating is key for optimal AR coating performance. Satisloh provides perfectly matching hard coatings to achieve highest AR adhesion and scratch resistance.

THERMAL DIP COATING

Dip coating is the right choice for labs that need to coat both sides of uncoated lenses and expect maximum scratch resistance and uniform performance on front and back.

It is the most economical solution for high volume labs that are able to coat in batches.

UV SPIN COATING

Spin Coating is the right choice for labs that want less complex production and a low investment with the highest process speed and the option to fully automate their hard coating process.

Using the new solvent based, non-tintable chemistry, labs can achieve extremely high scratch-resistance previously not possible with spin coating technology.

HARD COATING PROCESSES

<table>
<thead>
<tr>
<th></th>
<th>Spin Coating All Solids</th>
<th>Spin Coating Solvent Based</th>
<th>Dip Coating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scratch Resistance</td>
<td>● ● ● ○ ○</td>
<td>● ● ● ● ○ ○</td>
<td>● ● ● ● ○ ○</td>
</tr>
<tr>
<td>Tintability</td>
<td>● ● ● ● ○ ○</td>
<td>● ○ ○ ○ ○ □</td>
<td>○ ○ ○ ○ ○ □</td>
</tr>
<tr>
<td>Index Match</td>
<td>● ● ○ ○ ○</td>
<td>● ○ ○ ○ □</td>
<td>● ○ ○ ○ ○ □</td>
</tr>
<tr>
<td>Cycle Time</td>
<td>45-60 seconds</td>
<td>45-60 seconds</td>
<td>2-3 hours</td>
</tr>
<tr>
<td>Process Type</td>
<td>Single piece flow</td>
<td>Single piece flow</td>
<td>Batch</td>
</tr>
<tr>
<td>Lacquer cost</td>
<td>$$</td>
<td>$$$</td>
<td>$-$-$-$-$ $</td>
</tr>
<tr>
<td>Investment (facility &amp; equipment)</td>
<td>$</td>
<td>$</td>
<td>$$$</td>
</tr>
</tbody>
</table>

1) substrate can be tinted prior to hard coating
2) volume dependent
**DECISION #2: AR STACK**

*Cutting-edge vacuum technology. Satisloh has 50 years of experience developing AR coating stack designs. With increasing sophistication and controllability of vacuum chambers, it was possible to develop new and unique coatings with specific hardness, residual reflection, transmission, and other performance attributes.*

**STANDARD AR COATING PROCESSES***

![Legend of coating layers](image)

*Example for all possible Coatings*

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<table>
<thead>
<tr>
<th>Lens material</th>
<th>Premium</th>
<th>Performance</th>
<th>Classic</th>
<th>Multicote X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bayer value</td>
<td>7-12</td>
<td>5-7</td>
<td>2-5</td>
<td>N/A</td>
</tr>
<tr>
<td>Anti-static layer</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Cycle Time</td>
<td>25-45 min</td>
<td>23-43 min</td>
<td>27-29 min</td>
<td>51 min</td>
</tr>
<tr>
<td>Machines</td>
<td>1200-DLX-2</td>
<td>1200-DLX-2</td>
<td>1200-DLX-2</td>
<td>1200-DLX-2</td>
</tr>
</tbody>
</table>

*Abrasion resistance as defined by Bayer Ratio. Valid ONLY for freshly AR coated lenses with Satisloh lacquer DT1500 or DN1601 (Bayer Ratio ≥ 3)*

*Satisloh’s most advanced AR coating stack „Ultimate“ is available in the Ultimate coating package as described on page 7/8*
SPECIALIZED COATING STACKS

MIRROR COATING PROCESSES

Spectraflex X / -UV

- Dielectric mirror coating
  - Reflection colors: blue, red, orange, violet, green, silver, gold.
  - Solid mirrors, gradient mirrors, bi-color mirrors with sharp or gradient transitions.
  - Custom colors and custom color combinations possible.

- UV version: front side Spectraflex; back side Protect-UV. Highly recommended for sunglasses because of dilated pupils of the sunglass wearer.

Available for 1200-DLX-2, MC-380-X and MC-280-X

IN CHAMBER TINTING PROCESSES

- Organic and mineral lenses
  - Brown solid
  - Brown gradient
  - Grey solid
  - Grey gradient

- Mineral lenses only
  - Green solid

Various absorption levels available

Available for 1200-DLX-2, MC-380-X and MC-280-X

<table>
<thead>
<tr>
<th>Lens type</th>
<th>Protect-Blue</th>
<th>Protect-UV</th>
<th>Protect-Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benefits</td>
<td>Front side Blue Light protection. Reduces negative effects from tablets, smartphones, LED TVs, monitors, etc.</td>
<td>Back side UV protection</td>
<td>Front side Blue Light protection. Back side UV protection</td>
</tr>
</tbody>
</table>

Available for 1200-DLX-2, MC-380-X and MC-280-X
Hydrophobic
When the first easy-care top coatings were introduced, they were referred to as hydrophobic top coatings. Hydrophobic literally means “water-repellent”. The quality of a hydrophobic top coating is measured by the contact angle of a water drop on a lens. A higher contact angle (roundness of the drop of water) indicates better hydrophobicity. Traditionally, hydrophobic coatings have water contact angles between 97-104°.

Super Hydrophobic
Super hydrophobic top coatings have water contact angles over 106°.

Super Hydro/Oleophobic
The newest generation of top coatings has water contact angles over 110°, but even more importantly, also repels oil for example from human skin / fingerprints. This property is referred to as oleophobicity and is measured by the Dynamic Oil Contact Angle.

Cleanvac/Aulon
Traditional hydrophobic material with a water contact angle of 100 - 110°

Satin
Super hydrophobic/oleophobic material with a water contact angle 110 - 118° for maximum ease of cleaning.

All Satisloh top coating materials can be applied directly inside the AR vacuum chamber or in a separate vacuum chamber.

In addition, Satisloh offers convenient and cost efficient hydrophobic wipe-on solutions.

Phased Hydrophobic System: Grip*
A sacrificial overcoat is applied on top of Satin. It solves the slippage problem and provides unmatched yields for edging super-hydrophobic lenses. Grip can be wiped off after edging.

* Grip is not available in all countries
**SATISLOH ULTIMATE - OUR BEST COATING PACKAGE**

Combines our highest performing hard, AR, and hydrophobic coatings for the best of all worlds.

**Best Satisloh Hard Coating**
- DT1500 or DN1601 dip coating or U900 back side spin coating (with approved front side factory HC)*
- Specially developed for Ultimate AR stack
- Available for all other Satisloh AR coatings as well
- Available for most lens materials (CR39, high index, polycarbonate)

**Revolutionary AR Coating Stack**
- Ultimate high performance AR Stack
- Requires DT1500, DN1601 or U900 (with approved front side factory HC)*

**Completely new way of applying hydrophobic coating**
- Satin super-hydrophobic with special Extended Life (EL) treatment

*Additional hard coatings can be evaluated and approved by Satisloh via field acceptance protocol.

**Highest Possible Abrasion Resistance**

Our best hard coating plus newest AR stack plus best super hydrophobic means unequaled Bayer >12. Abrasion resistance exceeds the market benchmark by more than 50%. This outstanding hardness does not affect other coating characteristics such as thermal shock stability and environmental durability.

**Antistatic**

Antistatic property repels particles and dust, reducing the need for cleaning.

**Easiest lenses to clean with highest contact angle and extended life**

Satin’s ease of cleaning significantly exceeds the market benchmark as evidenced by the dynamic contact angle measurement. Special Extended Life (EL) treatment means that the hydrophobic layer remains effective much longer than the market benchmark, i.e. after a significantly larger number of dry wipe cleaning cycles (see graph “Slipperiness”).

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**Graphs:**
- **Abrasion Resistance**
- **Antistatic**
- **Slipperiness Over Time**
SATISLOH ULTIMATE - OUR BEST COATING PACKAGE

- Satin Topcoat
- Strong Bond Feature (SBF)
- Antistatic Layer
- AR Coating Stack
- Adhesion Layer
- Satisloh or Approved Factory Hard Coating
- Lens
- Satisloh Hard Coating