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.

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>● ● ○ ○ ○ 1)</td>
<td>○ ○ ○ ○ ○ 1)</td>
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<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>$-$-$-$-$-$ 2)</td>
</tr>
<tr>
<td>Investment (facility &amp; equipment)</td>
<td>$</td>
<td>$</td>
<td>$$$$</td>
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</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
Example for all possible Coatings
- Hydrophobic
- Topcoat
- Antistatic Layer
- AR Coating Stack
- Buffer
- Adhesion Layer
- Hard Coating
- Lens

<table>
<thead>
<tr>
<th>Lens material</th>
<th>Ioncote kX</th>
<th>Performance X</th>
<th>Multiquartz X</th>
<th>Multicote X</th>
<th>Easy-Coat</th>
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</thead>
<tbody>
<tr>
<td>Lens material</td>
<td>Organic</td>
<td>Organic</td>
<td>Organic</td>
<td>Glass</td>
<td>Organic and glass</td>
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<td>Bayer value</td>
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<td>5-7</td>
<td>2-5</td>
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<td>4-8</td>
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<tr>
<td>Anti-static layer</td>
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<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
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<tr>
<td>Cycle Time</td>
<td>25-45 min</td>
<td>23-43 min</td>
<td>27-29 min</td>
<td>51 min</td>
<td>Approx. 12 min</td>
</tr>
<tr>
<td>Machines</td>
<td>1200-DLX</td>
<td>1200-DLX</td>
<td>1200-DLX</td>
<td>1200-DLX</td>
<td>SP-200</td>
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<tr>
<td></td>
<td>1200-DLX-2</td>
<td>1200-DLX-2</td>
<td>1200-DLX-2</td>
<td>1200-DLX-2</td>
<td></td>
</tr>
</tbody>
</table>

1) 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 „Ioncote k+X“ is available in the ultimate coating package as described on page 7/8
SPECIALIZED COATING STACKS

**Ioncote kX-BLUE**
- Lens type: Organic lenses (clear)
- Benefits: Front side Blue Light protection.

**Ioncote kX-UV**
- Lens type: Organic lenses (clear and photochromic)
- Benefits: Back side UV protection

**Ioncote kX-CP (Complete Protection)**
- Lens type: Organic lenses (clear and photochromic)

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

MIRROR COATING PROCESSES

**Spectraflex X / -UV**
- Dielectric mirror coating
- UV version: front side Spectraflex; back side Ioncote kX-UV. Highly recommended for sunglasses because of dilated pupils of the sunglass wearer.


**ABSORPTION COATING PROCESSES**
- Brown solid, brown gradient, grey solid, grey gradient

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/Auron
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
THE ULTIMATE COATING PACKAGE:
IONCOTE k+X*

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 Ioncote k+X
- Available for all other Satisloh AR coatings as well
- Available for most lens materials (CR39, high index, polycarbonate)

+ Revolutionary AR Coating Stack
  - Ioncote k+X 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

*Brand name in North America is Ioncote Carbon

Revolutionary extra-hard AR coating stack requires Satisloh lacquers listed above. All components are precisely matched to each other and any substitute will result in failure.

Highest Possible Abrasion Resistance

Our best hard coating plus newest AR stack plus best super hydrophobic means unequalled 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”).

![Graphs showing abrasion resistance and antistatic properties](attachment:graphs.png)
THE ULTIMATE COATING PACKAGE:
IONCOTE k+X*

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