# Anti-Reflective Coating Technology

Technologies increasingly rely on high-performance displays to communicate information to the user. For applications like display panels, which are subject to dynamic sunlight conditions, it is critical that users always have a clear view of the display. The readability of displays can be dramatically improved by the application of anti-reflective (AR) thin-film coatings to reduce unwanted surface reflection of light. The spectral performance of AR thin-film coatings can be optimized to attain minimal reflectance from all viewing angles and for a broad range of wavelengths from the ultraviolet (UV) to the infrared (IR).

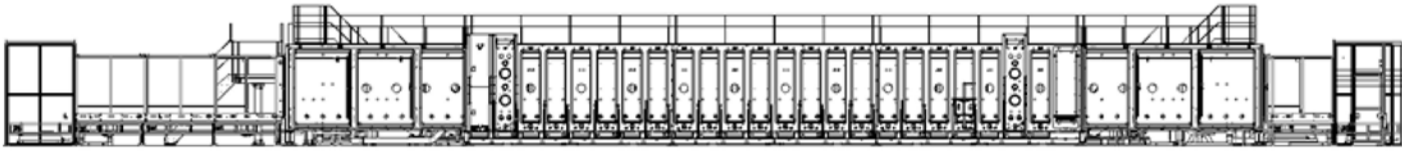
## Applications include:

- Touch panels
- Digital signage
- Optical filter solutions for sensors and cameras
- Interior vehicle displays

High-throughput coating equipment designed by AGC creates anti-reflective surfaces by applying a series of nanometer-scale oxide layers onto the substrate during a vacuum deposition process. The process yields a multi-layer coating stack of alternating high and low refractive index materials, which reduces light reflection and increases light transmission through the base substrate. This phenomenon is called thin-film interference and is exploited to improve the readability and other features of the display. The multi-layer AR coatings do not contain any metals, which enables outstanding abrasion and chemical durability of the coated displays.

AGC anti-reflective coating equipment employs a magnetron sputtering (PVD) process to coat glass or polymer (e.g. PC, PMMA) sheets. Superior coating thickness uniformity is precisely controlled across the substrate width by online shimmable magnet bars designed behind specially-adapted dual magnetron cathode assemblies.

A high-throughput mass production line with lowest total cost of ownership (TCO) is realized with a linear inline system. Substrates are loaded onto holders which move alongside carriers through the coater. Loading and unloading of substrates onto holders is automated or can be performed manually. The line can be delivered with a fully automated carrier return system.



Unlike systems from traditional equipment suppliers, each AR coating line is custom-designed by AGC based on the complexity of the AR coating and production capacity requirements. AGC engineers rely on proprietary modeling software, multiple test coaters, and decades of experience scaling complex coating stack products for mass production, to ensure the coating line is optimized for each customer's application. The correct number of cathodes and gas separation zones will be determined and the appropriate process and quality control equipment will be integrated into the line to assure highest quality output at the lowest TCO. Integration of turbo molecular pumps directly onto the cathode lids results in a compact coater design with minimal footprint and low energy consumption. AGC anti-reflective coating equipment is modular and easily allows future upgrades of the coater line for improved performance, new products, or increased production capacity.

## BENEFITS

- High-throughput coating line relies on AGC's industrially proven magnetron sputtering (PVD) technology with superior process stability and reproducibility
- Highest quality coatings
- Low particle pollution and coating uniformity unmatched in industry
- Custom-engineered sample holders to optimize line coverage and maximize machine output
- Coating line equipped with automated carrier return system hosted in a clean room to avoid dust contamination
- Modular and flexible equipment design easily allows future system upgrades
- Quick switch-over times between different coatings maximizes machine uptime
- Substrate pre-cleaning and quality control equipment integrated into system for turnkey operation
- User-friendly operating system and easy maintenance
- Remote access possible for quick troubleshooting by AGC support team

| Technical Specification | |
|---|---|
| Coating stack and final performance | multi layer stack : H / L / H / L / ...<br><br>L: examples of low index dielectric materials are silicon oxide ($SiO_x$), aluminum oxide ($Al_xO_y$), …<br>H: examples of high index dielectric materials are titanium oxide ($TiO_x$), niobium oxide ($NbO_x$), tantalum oxide ($Ta_xO_y$), zirconium oxide ($ZrO_2$), silicon nitride ($Si_xN_y$)<br><br>Residual reflection below 0.5%<br>High transmission and increased contrast |
| Substrate forms | Sample holders compatible with various sheet dimensions |
| Substrate materials | Glass, polymer, … |
| Coating uniformity | +/- 0.5 % (on flat substrate) |
| Campaign length maximum | Four (4) weeks |
| Annual production capacity | 2.5 million m² (customizable) |
| Cathode | Dual rotatable cathodes with gas trim and online shimmable magnet bar (iOSMB) technology to maximize deposition rate |
| Power source | Bipolar pulsed DC power supplies with superior arc management to assure highest quality coatings |




**AGC Plasma Technology Solutions** is the industrial coatings unit of the world's largest glass producer AGC Inc. (Asahi Glass Company) and a one-stop provider for plasma-based vacuum coating equipment. The group leverages decades of thin-film coating experience on large area glass products to innovate and develop new industrial solutions from proof-of-concept to mass production. AGC Plasma Technology Solutions operates R&D and production facilities across the United States, EU, and APAC.

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