Atomic Layer Deposition of conformal optical interference coatings

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Atomic Layer Deposition of conformal optical interference coatings *industrially*

- For commercial production of
  - Multiple optics per coating run
  - Large optics
- Industrial tools (e.g. Beneq P400A, P800) are used for low cost per coated item
Atomic Layer Deposition of conformal optical interference coatings

- Vacuum coating (1 mbar) method
- One precursor (chemical) at a time on surface
- Self-saturating surface reactions
- Purging step between precursor exposures

Schematic of an ALD cycle. Beneq Oy.
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- Conformality is enabled by surface-controlled growth
- From micro- to macro-conformal
- No rotation/movement of samples required
- Optimization for shapes – easy to construct test structures

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- Macroconformality is simple to study and prove on custom shapes
- Process can be further optimized for a specific shape

Above: Schematic of a 150 mm -sided top-open cube. Glass substrate attached to each side.

Left: Measured transmission of glasses after ALD-$\text{Al}_2\text{O}_3$ deposition
Right: Fitted thickness values (nm) for corresponding sides. Variation < 0.4 %
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- All “typical” coatings easily realizable from design
  - AR
  - HR
  - Bandpass/Bandstop
  - Beamsplitters
- Typically, no in-situ monitoring is required (repeatable layer-by-layer growth)


ALD-Al2O3/TiO2 short-wave edge pass filter (5.5 µm thick). Beneq Oy.
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- Engineering of materials easy to perform
- Optical properties of laminated ALD-$\text{Al}_2\text{O}_3$-$\text{TiO}_2$ films investigated (figures)
- Behaviour predictable and easy to model
- Example application: Apodized rugate bandstop filter
For more information and discussion, come meet us!

Poster TEP.5
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Beneq® is a leading supplier of production and research equipment for atomic layer deposition (ALD), a provider of thin film coating services, and the world’s premier manufacturer of thin film electroluminescent (TFEL and TASEL) displays.