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Main Office

Beneq Oy
P.O. Box 262
FI-01511 Vantaa, Finland

Visiting address:
Ensimmäinen savu
FI-01510 Vantaa, Finland

Tel. +358 9 7599 530
Fax +358 9 7599 5310

firstname.lastname@beneq.com
info@beneq.com
www.beneq.com

Sales and Service Offices

Beneq China    Beneq Germany    Beneq USA

Aerosol Coating Technology
Beneq aerosol coating technology

Beneq develops and delivers aerosol coating equipment and processes for thin film coating applications. The two aerosol coating processes offered are in-house developed Beneq proprietary technologies.

Development of aerosol methods within Beneq started with nHALO, a flame-based nanoparticle generation process originally developed for coloring art glass. Beneq has turned it into an industrial scale processing technology with several applications in development.

The second aerosol process is nAERO. It was developed to fill the rapidly escalating need for a flexible, tunable and alternative thin film coating method for advanced coatings on glass. The driving application for nAERO is transparent conductive oxide (TCO) coatings, which allows the cell manufacturer to optimize the coating to suit specific needs and thus maximize the efficiency of the thin film cell.

Industrial thin film case: photovoltaics

With the surge of photovoltaics (PV) in the world today, solar cell manufacturers are looking for more economical coating solutions for their production lines. nAERO, an aerosol-assisted pyrolytic coating method from Beneq, presents a technically superior and economical coating method for in-line and off-line coated products. nAERO is capable of producing low-haze and high-haze transparent conductive oxide (TCO) coatings, which allows the cell manufacturer to optimize the coating to suit specific needs and thus optimize the combination of haze, conductivity and transmittance.

In the nAERO process, the coating precursors are fed into a coating chamber as liquid droplets and the droplets are directed towards the surface of the glass substrate to be coated. The primary droplet size distribution of this aerosol is of great importance for the resulting thin film.

The glass substrate is brought to the coating process at such a temperature that the thermal energy of the glass substrate is able to vaporize the droplets close to the surface of the glass substrate, before the droplets impact the surface of the glass. The schematic below presents the basic setup for nAERO coating.

Alternatively, the aerosol can be used for room temperature production of uniform, wet coatings.

The main benefit of the nAERO process is that it combines the advantages of spray pyrolysis and CVD in such a way that the challenges commonly associated with these methods are avoided. In short, nAERO offers:

- high thin film growth rate
- efficient use of raw materials
- minimal detrimental process-related particle formation
- suitable for different kinds of applications, both in- and off-line
- designed for use in normal air pressure

The nAERO process has successfully been implemented both for the production of TCO coatings (for low-e and PV applications, see below) and for self-cleaning coatings.

Efficient raw material usage

nAERO coating is based on sub-micron sized droplets that are directed to the glass substrate. This enables a high growth rate and good material economics, with a raw material (precursor) yield of 20% or better.

The extensive range of coating equipment and thin film applications offered by Beneq today fulfills the needs of both industry and research. For full flexibility of production setup, aerosol coatings can be applied both in- and off-line, depending on the application and customer requirements.

www.beneq.com
Beneq aerosol coating technology

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nAERO® — aerosol-assisted coating

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nHALO® — flame-assisted coating

Beneq Hot Aerosol Layering Operation, nHALO, is based on the combustion of gaseous and atomized liquid raw materials in an atmospheric oxy-fuel flame. This evaporation-gas condensation method produces nano-sized particles of metal oxides, e.g., TiO₂, noble metals, e.g., Ag, and mixing of the raw materials, leading to combinations thereof, e.g., TiO₂ - Ag.

Flexibility in raw material feeding gives the freedom of incorporating raw materials with very different vapor pressures. A turbulent flame provides for efficient generation of nanoparticles. Rapid quenching and a short residence time produces particles with a narrow size distribution.

Industrial thin film case: photovoltaics

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nAERO-TCO is a pyrolytic coating consisting of fluorine-doped tin oxide (SnO₂:F). The coating parameters can easily be adjusted to optimize the combination of haze, conductivity and transmittance.

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- high thin film growth rate
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- designed for use in normal air pressure

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Beneq aerosol coating equipment

The extensive range of coating equipment and thin film applications offered by Beneq today fulfills the needs of both industry and research. For full flexibility of production setup, aerosol coatings can be applied both in- and off-line, depending on the application and customer requirements.

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