

VON ARDENNE 

EB-PVD COATING SYSTEM FOR TURBINE BLADES

TUBA

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TUBA COATING SYSTEM

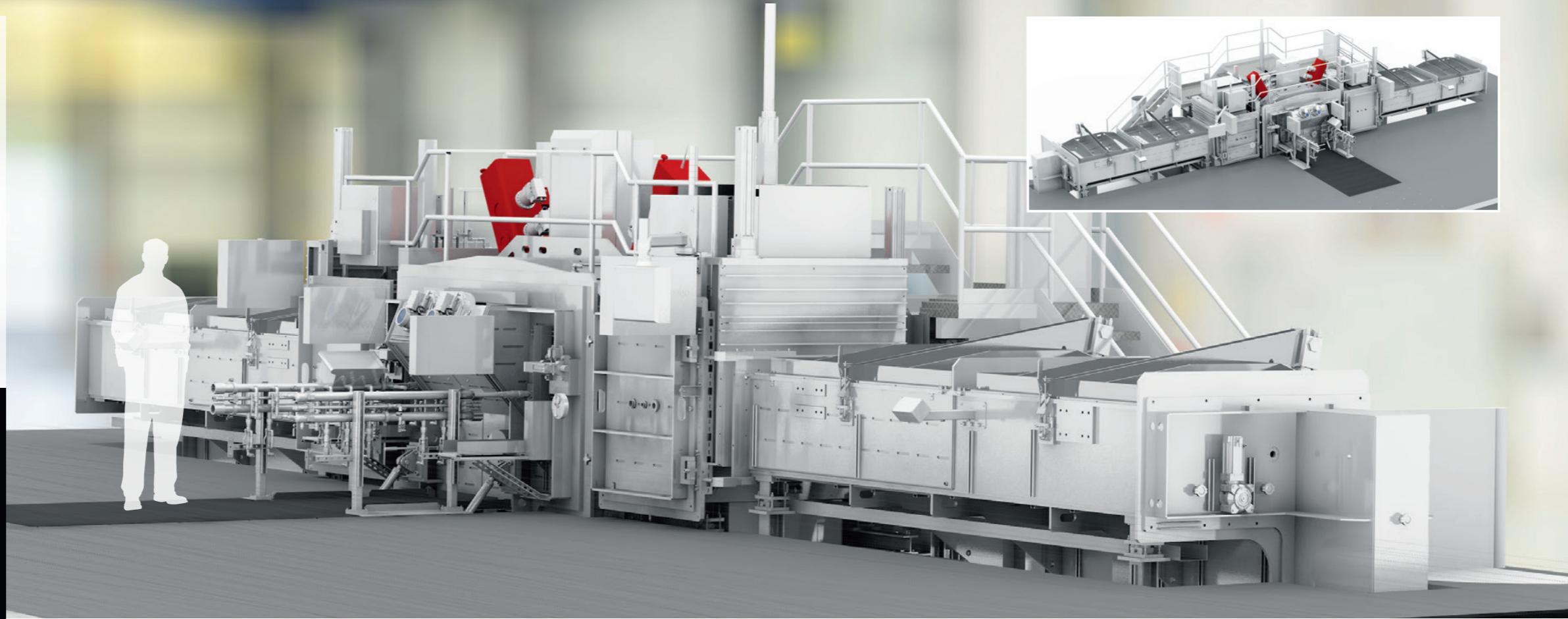
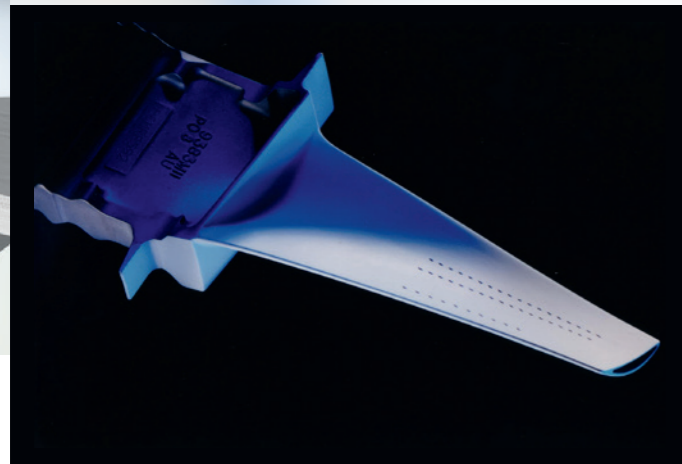
The new state-of-the-art EB-PVD system for the thermal barrier coating of hot section aero engine and industrial gas turbine components

APPLICATION

VON ARDENNE provides thermal barrier coating solutions for hot section components of modern aero engines. These solutions are based on electron beam evaporation technology and include equipment, key technology components and application technology.

The TUBA is an EB-PVD turbine blade coating system with a modular design. It is ideally suited for high-volume production or the refurbishment of aero engine components and those of stationary gas turbines. The TUBA can be configured with one or two substrate handling systems.

As a leading provider of industry-proven vacuum deposition equipment for large-area coating, we have incorporated our broad knowledge and expertise in EB-PVD technologies into this platform.



KEY FEATURES

- ... Substrate handling by novel, robust substrate feeder concept with on-board drives, providing fully programmable rotation and tilting of the components during coating
- ... Thermal radiation heating in fully insulated heater structure - rapid heating at excellent uniformity of up to 1200 °C
- ... High-rate EB evaporation of TBC layers from ceramic ingots
- ... Industry-leading VON ARDENNE electron beam equipment
- ... Superior maintenance concept

FLEXIBLE DESIGN ADAPTED TO PRODUCTIVITY REQUIREMENT

The coater can be equipped with one-sided or double-sided substrate feeding. Therefore, the productivity and the investment costs can be adapted to the individual requirements of the customer. It is also possible to upgrade the system from the one-sided to the double-sided version.



PROVEN ELECTRON BEAM TECHNOLOGY

Our electron beam equipment with a patented VARIOCATHODE ensures a perfect beam focus even under extremely challenging process conditions. This is the basis for a stable high-rate evaporation process.

LOAD CHAMBER

Optimized for high throughput by fast substrate exchange and options for rapid pump down

HEATING CHAMBER

- ... Heating of the substrates to up to 1200 °C by thermal radiation heater
- ... Novel heating box design fully enclosing the substrates ensures minimal power consumption and perfect homogeneity

COATING CHAMBER

Two EB evaporation sources, each providing a material stock of 10 m of ingots, allowing for YSZ evaporation rates in the range of 7.5 µm/min measured on rotating parts. The process environment and conditions are optimized for generating a perfect columnar microstructure of the thermal barrier layer.

ADVANCED COATING OPTIONS

Advanced process options such as dual material feeding, substrate bias, plasma pretreatment, are available upon request and can help to optimize the coating quality of next-generation turbines.

EASE OF MAINTENANCE AND SHORT DOWNTIMES

In order to shorten downtimes, the TUBA is optimized for accelerating maintenance tasks and the preparation for production, incorporating several patented industry novelties. Please do not hesitate to contact us for more details.

SUBSTRATE HANDLING SYSTEM [ONE PER SIDE]

The substrate handling system (trolley) serves the purpose of both transferring the parts between chambers and rotating and tilting them within the vapour cloud.

The trolley is equipped with two rakes that can be tilted in butterfly mode or tandem mode.

The rotation and tilt drives are contained within the trolley, which ensures a short and failure-proof mechanical transmission path.

	Butterfly 45° downwards	Butterfly 45° upwards	Tandem +/-45° & -/+45°
Loading chamber		<input checked="" type="checkbox"/> open lid	
Heating chamber			
Coating chamber	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

TECHNICAL DATA

Subject to change without notice due to technical improvement.

SUBSTRATE DIMENSIONS AND MOVEMENT

Max. substrate length (including head, root and tooling)	about 420 mm
For parts supported by both rakes	about 420 mm
For parts supported by one rake in alternate positions	about 220 mm
For parts supported by one rake in opposite positions	about 220 mm
Max. weight (sum of all substrates incl. two rakes and toolings)	100 kg
Substrate rotation	3 rpm to 60 rpm
Substrate tilting	± 45°

HEATING CHAMBER

Final temperature	max. 1200 °C
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COATING CHAMBER

Number of evaporators	2
Diameter of ingot	63 mm
Dynamic coating rate for YSZ (on a rotating part)	about 7.5 µm.min ⁻¹
Ingot capacity for each evaporator	10000 mm
Substrate temperature during coating	900 °C to 1200 °C
Chamber atmosphere	O ₂ /Ar 10 ⁻³ mbar to 2 x 10 ⁻² mbar

EB GUNS

Acceleration voltage	max. 40 kV
Power	2 x 150 kW
Average lifetime of solid cathode	≥ 200 h

OUR STRENGTHS

In-House Technology & Application Center

- Sample coatings of customer applications
- Development of customized layer stacks
- Product & process verification and optimization
- Testing of new technologies and components

Professional Simulation Support

We offer professional simulation technology to ensure best process quality with regards to plasma, heat and cooling. Furthermore, our simulation tools help demonstrate, develop and improve layer properties and define or optimize processes, details and the performance of our systems.

Close Partnership

VON ARDENNE has a network of partners for even more profound R&D work and to identify future technologies. It consists of:

- Fraunhofer Institutes
- Institutes of the Helmholtz Association
- Universities
- Companies

Global Project Experience

VON ARDENNE equipment is used in over 50 countries. We have established an installed base of hundreds of coating systems worldwide, ranging from small tools to equipment for large-area coating applications for several markets.

Comprehensive Service Portfolio

- VON ARDENNE service hubs around the world
- On-site service
- Remote access by our technology department
- Regular technical and technological trainings
- Spare & wear part warehouse close to customers
- Lifecycle extension of wear parts

Upgrades & Retrofits

As soon as your business is growing, your VON ARDENNE equipment will grow accordingly - thanks to its modular design and the upgrades we provide. We will also supply you with the necessary technology upgrades if you decide to change your applications.

Furthermore, when your equipment is ageing, we will retrofit your systems with new components, no matter if they are VON ARDENNE or third-party machines.

WHO WE ARE & WHAT WE DO

VON ARDENNE develops and manufactures industrial equipment for vacuum coatings on materials such as glass, wafers, metal strip and polymer films. These coatings give the surfaces new functional properties and can be between one nanometer and a few micrometers thin, depending on the application. Our customers use these materials to make high-quality products such as architectural glass, displays for smartphones and touchscreens, solar modules and heat protection window film for automotive glass.

We supply our customers with technologically sophisticated vacuum coating systems, extensive expertise and global service. The key components are developed and manufactured by VON ARDENNE itself. Systems and components made by VON ARDENNE make a valuable contribution to protecting the environment. They are vital for manufacturing products which help to use less energy or to generate energy from renewable resources.

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