Advanced coating equipment from Germany

The German family-owned company VON ARDENNE develops and manufactures advanced vacuum coating equipment for the photovoltaic and solar thermal industry, the architectural glass coating market, and the web coating market. We take a closer look at the company, which is constantly identifying and analysing market trends throughout these industries in order to strengthen and broaden its technology portfolio.

Today, VON ARDENNE’s key technologies are magnetron sputtering and electron beam evaporation and it holds more than 600 patents worldwide. However, the company was founded in 1991 as a spin-off of the former Manfred von Ardenne Research Institute in Dresden, Germany. A consequence of this was that the expertise in plasma and electron beam technologies that had been acquired over decades could be used and developed further.

The company owes its name to Manfred von Ardenne, a highly gifted, visionary and tenacious scientist and inventor born in 1907. His contribution to inventions such as the radio receiver, the television, and the scanning electron microscope is extraordinary. He held approximately 600 patents in radio and television technology, electron microscopy, nuclear plasma, and medical technologies and was the author of countless books and publications – all done without holding a degree or even a high school diploma. It was thanks to his farsightedness and hard work that he progressed from school dropout to famous scientist.

Today, VON ARDENNE offers high precision vacuum coating equipment such as the PIA|nova coating platform. It is an industry-proven solution for applying thin metal and transparent oxide (TCO) layers on thin-film and wafer based solar cells. The main applications are functional layers for:

- Copper indium and gallium (CIGS) thin-film cells
- Back contacts based on molybdenum including different barrier layers
- Precursor based on copper, indium and gallium for all technologies using a sequential precursor and selenisation process
- Front contacts based on intrinsic zinc oxide and aluminum doped zinc oxide
- Cadmium telluride and silicon based thin film cells
- Back contacts based on different metals
- Crystalline solar cells using heterojunction with intrinsic thin layer (HIT) technology
- Transparent conductive oxides
- Metal contact layers

The PIA|nova is based on VON ARDENNE’s proven inline coater design. The substrates are coated in a continuous process, and once the process setup is complete, the coater can run for days without interruption. The length of the campaign time depends mostly on the sputtering target material thickness and utilization and on the target design itself. Apart from magnetrons with planar targets, VON ARDENNE offers rotatable magnetrons. Using rotatable instead of planar targets can contribute tremendously to prolonging the campaign time as the target utilization of up to 85% is much higher compared to planar targets. That means that more target material can be used for the coating processes before the targets need to be exchanged. Additionally – based on the sputter characteristics of rotatable magnetrons – the particle behavior is much better compared to planar targets.
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During the last decade, VON ARDENNE has developed its own rotatable magnetron technology and has integrated it successfully into its coating systems, which are sold all over the world. VON ARDENNE offers:

- Rotatable dual magnetrons for alternate current (AC) sputter processes for the deposition of many low-conductivity or non-conductive layers
- Rotatable single magnetrons in double or single arrangement for direct current (DC) processes for the deposition of conductive layers
- In combination with rotatable single magnetrons the VON ARDENNE dual anode sputter system (DAS) which enables the VON ARDENNE customers to run long term stable sputter processes depositing very low/non-conductive materials with direct current
- Proven planar magnetron technology with different magnetic field characteristics for a wide range of materials

The VON ARDENNE rotatable magnetron and a successfully completed in-house development program are the foundation for the horizontal coater design which includes the sputter-down arrangement. With a coating width of up to 1.4m, the PIA|nova is suited for the majority of common substrate sizes. The coating system offers a throughput of up to 250 square metres per hour for thin-film photovoltaics on glass based substrates or more than 3600 wafers for crystalline wafer based substrates. Wafers are transported with the help of carriers. On the other hand, glass substrates for thin-film photovoltaics are typically transported in a carrier-less process.

As VON ARDENNE is one of the leading manufacturers of coating equipment for the architectural glass industry, the company has proven that its systems can meet the high uniformity requirements and extraordinary process stability on large-area substrates. The horizontal glass coating system GC330H, for example, is able to coat glass substrates up to 3.3m wide and 7.8m long. This coating system sets the industry standard for large area thin-film deposition.

Furthermore, VON ARDENNE offers the vertical glass coating system GC60V for thin-film photovoltaics applications. This coater can process substrates of a width of up to 0.6m and a length of 1.5m.

The main fields of application for the GC60V coating system are functional layers for:

- Metal back contacts for copper indium and gallium (CIGS) thin-film cells
- Metal back contacts for cadmium telluride and silicon based thin-film cells

The GC60V is ideal for customers who do not require the throughput magnitude of the PIA|nova. It is an inline system with carrier-less design and uses the VON ARDENNE planar magnetron technology most efficiently.

For applications requiring flexible substrates, VON ARDENNE supplies two different coating systems. The metal strip coating system MSC1250 deposits functional layers on aluminum, copper, or stainless steel strip that is up to 1.25m wide. The coater combines the two VON ARDENNE key technologies: magnetron sputtering and electron beam evaporation. Apart from solar thermal absorbers, coatings for highly reflective mirrors for concentrated solar applications are a key field of application for such a coating system.

VON ARDENNE also offers a coating platform for polymer web applications. The FOSA1600 web coating system can handle up to 1.6m wide PET (polyethylene terephthalate) foils. Examples of photovoltaic applications of the FOSA1600 are the deposition of contact layers made of metals or transparent conductive oxides (TCO).

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