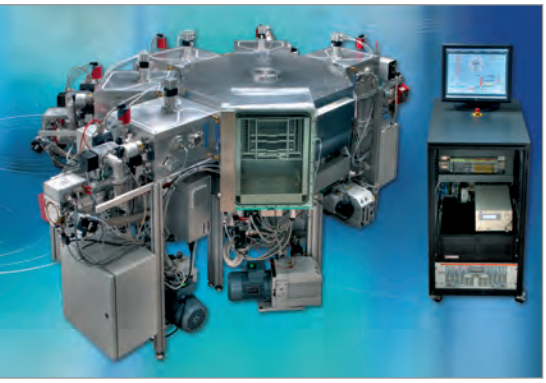
Innovative Engineering Technology and Design for delivering the next generation equipment for fabrication and optimization of PV devices

In the race to increase PV devices efficiency while still keeping operational costs down, it is mandatory for R&D labs and solar cells manufacturers to be armed with a highly flexible process development tool that can be successfully used by several groups and on different projects without sacrificing excellence and quality. Committed to meeting and exceeding the demands of the market, INDEOtec, a Swiss company led by Dr. Omid Shojaei, is revolutionizing the R&D and Pilot Production equipment industry with the creation of the Octopus family line, a series of thin film deposition tools offering state-of-the-art closed-concept PECVD reactors and multiple PVD sources on a common cluster type platform.

Dr. Omid Shojaei

The key factor driving the success of R&D labs that are actively involved in the design, fabrication and optimization of the next generation's PV devices is the ability to have access to the latest available processing tools that the market can offer.

Developed by the Swiss company INDEOtec, the **Octopus** has been created by a technology and engineering team that is armed with over 30 years of professional experience in the thin film deposition equipment and solar PV industries. The Octopus, a high-end thin film deposition tool, is a revolutionary tool that specifically addresses the needs of R&D labs and pilot production purposes. Thanks to the high design and technology put in place into the building of this high throughput equipment, it allows the production of multi-stack layers inside one single system without ever exposing substrates to atmosphere and moistures. These features make Octopus the ideal process development tool in PV, TFT, OLED and MEMS.



Octopus I

Getting to know the Technology inside the Octopus Equipment:

All Octopus products come equipped with INDEOtec's proprietary "IRFE" or Integrated Radio Frequency Electrode PECVD reactor technology. This exclusive technology offers exceptionally stable plasma with high uniformity of plasma on the deposited substrate for an extremely large and wide process regimes in term of gas mixtures, hydrogen partial pressure and content, process pressures and plasma excitation powers.

Main characteristics of the reactor include:

- Gas shower head allowing very high uniformity/quality films.
- Excitation frequency from 10 to 100 MHz.
- Adjustable inter-electrode distance from 10 to 25 mm.
- Pressure from 0.1 to 20 mbar. • Power density from 4 mW/cm2 up to 1W/cm2 and more.
- Closed reactor allowing differential pressure system and high purity films.
- Insitu plasma etching with fluorinated gases.

Types of PECVD deposits include intrinsic and doped a-Si:H, a-SiGe:H, a-SiO:H, a-SiC:H, mc-Si, SiOx, SiNx…

In regard to metal or TCO coatings, Indeotec only works with top international developers of sputtering sources and integrates third party magnetron design to our PVD chamber, which can take up to four different materials targets/ magnetron. Typical deposits include, ITO, ZnO, Ag among many other possible combinations.

Types of solar cells that can be synthesized by the Octopus cluster tool include Crystalline Silicon (c-Si), Hetero-Junctions (a-Si/c-Si) and Thin Film Silicon (TF-Si).

Expansion of the Octopus Family:

INDEOtec, which features the Octopus I for R&D Small Area deposition (5" wafers or glass) has recently revealed a new addition to its product line, the Octopus II for Larger Area deposition (350 x 450 mm2 glass or accommodation of silicon wafers batches: 4 x 6" wafers or 6 x 5" wafers). Octopus II is declined in 3 various options:

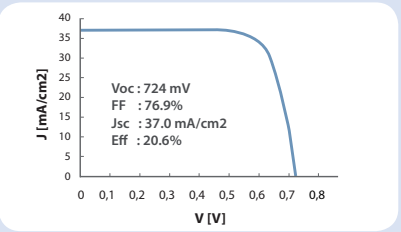
- Manual Mode with up to 2 process modules (low cost version),
- R&D (fully automated with up to 8 process modules and load lock)
- Pilot Production PP (fully automated with up to 8 process modules and load lock and each process module equipped with own gas box, process pump, and power generator allowing parallel processing and therefore high throughput).

Octopus II Pilot Production is also a fully upgradable option to the Octopus II.

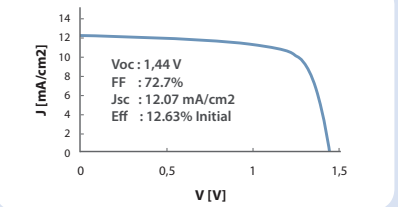
Results

Because of their unique characteristics, the Octopus allows obtainment of extremely satisfactory results such as the ones that can be see on the charts below:

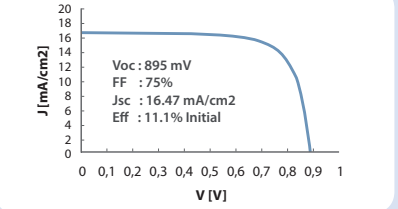
- **c-Si HJT solar cell**



- **micro-morph n-i-p solar cell**



- **a-Si:H p-i-n solar cell**



These results have been successfully proved and confirmed by Switzerland's PV-Lab, part of the renowned Ecole Polytechnique Fédérale de Lausanne, who relies on Octopus for their continuous R&D efforts towards fabrication and optimization of solar cells.

INDEOtec
PLASMA PROCESS EQUIPMENT

Meet INDEOtec team at :

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