

EVATEC YOUR PARTNER IN MICRO LED

The layer types may be the same, but the demands are different for the new emerging micro LED technology when compared with conventional LED production. **Stefan Seifried**, Head of Business Unit Optoelectronics summarizes the current state of play.

Delivering proven solutions

After long years of experience in the LED field, two different configurations of the CLUSTERLINE® 200 product have already been qualified for our customers' value chain in the field of micro LED. The first platform equipped with a Batch Process Module (BPM) is a well known "LED workhorse" implemented new and improved features for Micro LED. The second is a variant equipped with Single Process Modules (SPM) with a pedigree second to none in the semiconductor industry. Both toolsets offer production capabilities for metals, TCO, DBR and passivation layer deposition and are approved by at least five major customers for micro LED products.

Meeting new requirements

While in "mature" regular LED production, factors like cost of ownership, plus technical drivers like LOP (light output), and Vf (forward voltage) have been more important of late, at the current "market entry" status for micro LED other factors play a much more important role. For example, the smaller dimensions, and thinner layer structures compared with conventional LED products, mean that thickness uniformity plays a critical role while particle generation must be kept at an absolute minimum to achieve higher wafer device yields. Tool and process stability will be key since the overall yield of the wafer determines the cost of device transfer (pixel) to the display. In addition, avoidance of manual handling by automation is the key for future production.

**"THINNER STRUCTURES
COMPARED WITH
CONVENTIONAL LED
MAKE LAYER THICKNESS
UNIFORMITY CRITICAL"**

Accurate process control for thin films

Evatec's CLUSTERLINE® 200 equipped with SPMs enables damage free, thin layer deposition at high throughputs by employing facing target cathode / bulk cathode sputtering. This is a key advantage for TCOs as well as metal layers which are directly deposited on top of the compound semiconductor layer. Whereas facing target sputtering results in a low damage process for contact layers, the subsequent bulk layer can be sputtered with a regular DC or DC/RF process. In addition, both processes can be integrated into one process module and switched automatically. Up to 6 modules can then be connected to the central transport module for increasing throughput if required. This process is approved for micro LED production by major customers in the automotive and wearable industries.

Another example of success is found in the CLUSTERLINE® reference tool for ITO in the market equipped with its batch process module. Its already the industry standard for running standard LED processes (TCO / metal / DBR) but in its latest guise its also now perfectly suited to address the more sophisticated Micro Display (MD) market with its more demanding processes.

A new, higher performance rotating chuck table, with with 20+1 positions for 6 inch wafers, where one wafer is used as monitor wafer has already been production qualified. As an option, this table is also available for 8 inch albeit at lower throughput.

The chuck rotation is realized by individual, direct driven motors. In combination with the overall table rotation this allows thickness uniformities in general well below 1.5%, and for certain materials well below 1%. Customer feedback tells us that this should exceed the market and process requirements expectations for the next years. To assure maximum throughput even for challenging processes (e.g. TiO₂ in newer type DBR processes), the system is also equipped with a plasma emission monitoring (PEM) system for in-situ adjustments to reach optimum deposition rates.

FROM R&D TO PILOT PRODUCTION OR VOLUME MANUFACTURING WE HAVE THE RIGHT SOLUTION

A portfolio of solutions for Micro LED



Dynamic batch sputter system:

CLUSTERLINE 200® equipped with a BPM is the LED industry reference for ITO layer sputtering

- Dynamic, shielded, damage free sputtering
- Rotating chuck 6 and 8 inch
- Hot ITO process possible
- DBR and metal sputter



Single process module system:

CLUSTERLINE 200® equipped with SPMs e.g. Facing Target Cathode (FTC) & Multi-Source Cathode (MSQ)

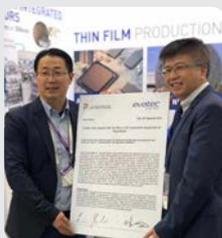
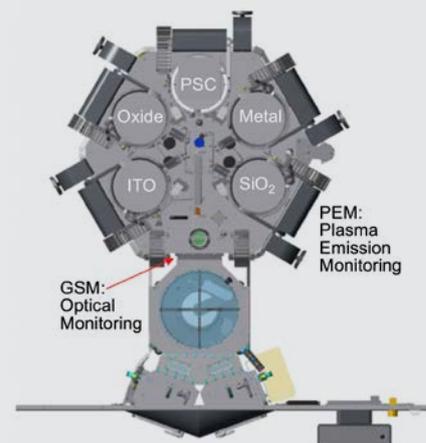
- Cluster tool with up to 6 modules (PVD, PVE)
- Vacuum separated chambers
- 6 auxiliary modules (degas, cool, align, metrology, buffer)
- Up to 8" wafers/glass
- Sputter (DC, RF), Soft Etch, PECVD
- Different materials and setups
- Max. temperature 500°C
- Ultrathin damage-free ITO contact layer

Configure a micro LED tool that fits your needs

Evatec is ready to support you with a tool configuration that fits for you. At R&D or pilot production stage we can propose a system layout based on CLUSTERLINE® 200 equipped with a BPM that combines metal and oxide layers in one tool with the benefit of full flexibility but at lower investment costs. For subsequent production we would then recommend process separation to assure highest throughput at lowest process complexity.

- Keep flexibility for other substrate sizes
- Process monitoring (PEM)
- Rotating chuck for better uniformity
- Plasma (PSC) source for reduced surface roughness
- Production layout would separate processes
- Further future deposition technologies can be integrated

I am sure we are able to find the right solution for your production path. Simply call us to get started!



Evatec and PlayNitride partner on Micro LED

At the end of 2019 Evatec announced an agreement with Taiwan based PlayNitride for the delivery of multiple thin film production tools enabling ramp up of their Micro LED production.