evatec
process systems

Indium Tin Oxide

the right configuration for every application

BAK 641

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ITO evaporation made on a BAK 641 coating system

Indium tin oxid (ITO) is used to make transparent conductive coatings. The thin film layer was deposited by electron-beam evaporation system in a reactive, high temperature process. Typically applications of ITO thin films are in optoelectronics, solar cells and in the LCD industry.

ITO coatings can be made in the BAK 641 coating system. The key features of the BAK 641 are:

- Compact system design with optimized throughput on small footprint
- Excellent reliability and cost of ownership
- Good uniformities
- User friendly GUI (Graphic User Interface)

The BAK 641 is available with different evaporation sources:

- Resistance heated sources
- Electron beam sources ESQ212 – digitally controlled with various types of crucibles (pot, multipocket, with liners) for all types of materials:
- Inductive heated sources for micro electronics
- Chimney sources for sublimating materials
- Special sources for large quantities of evaporated materials.

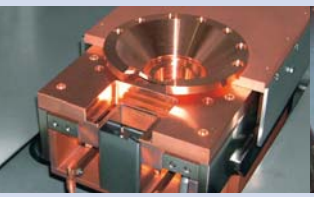
The BAK 641has the state of the art control system KHAN. KHAN Process Control with user-friendly Graphic User Interface set fully automatic production process sequence based on Semi standards (SECS I/II, alarm management, real time trending, process statistics, RGA integration, data collection, maintenance statistics etc.)

The specifications of the BAK 641 coating system used for a ITO evaporation are shown below.

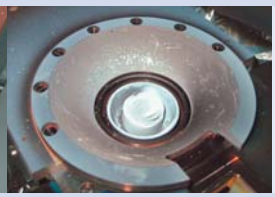
Typical process data

Substrates: Si and glass wafer, 2 inches
Pumpdown including heat up: 1 hour

Material	Measurement	Amount
Layer		1
Material		ITO
Form		Tablets
Composition	In/Sn	80/20
Process		
Layer		1
Thickness	nm	200 – 260
Rate	nm/s	0.1 – 0.2
Material consumption	per run	1/2 tablet
Temperature	°C	about 350°
Process pressure	mbar	3 x E – 4
Source		
Layer		1
Voltage	kV	7
Emission	mA	55
Liner material		molybdenum



Source ESQ212



Source with ITO

Temperature uniformity test

Equipment:

Deposition system

- Standard BAK 641 system
- Source out of centre
- See product information sheet

Pumping system

Cryopump, forepump station, soft roughing device and vacuum valves, four vacuum control gauges (1 PBR, 1 PKR, 2 TPR)

Control

- System controller KHAN
- Rate control XTC/B

Evaporation source

- 1 electron beam gun ESQ 212
- 4 pocket modular crucible

Accessories

- segmented dome
- shaped substrate holder
- oxygen inlet
- quartz heater
- correction shield

Results:

Distribution/reproducibility

- Standard distribution radial ±2%
- Standard reproducibility ±2%

(batch to batch at the same point on substrate holder)

Transmittance 200 nm ITO

Measured on glass wafer by spectrometer:

- Transmittance > 88% at 465 nm
- Transmittance > 98% at 625 nm

Resistivity 200nm ITO

Measured on Si wafer by 4-point prober:

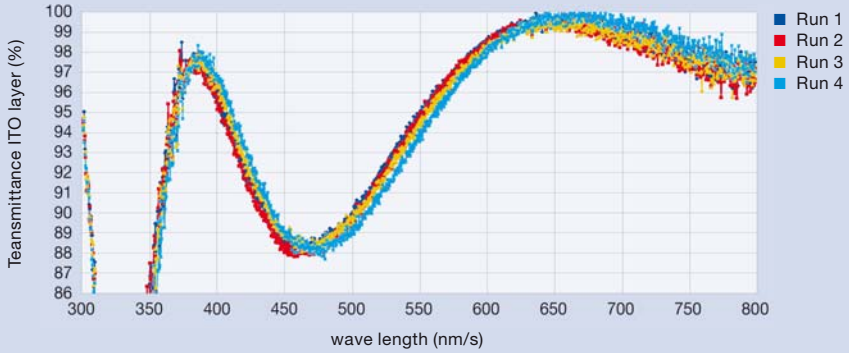
Resistivity < 10 ohm/sq

Throughput

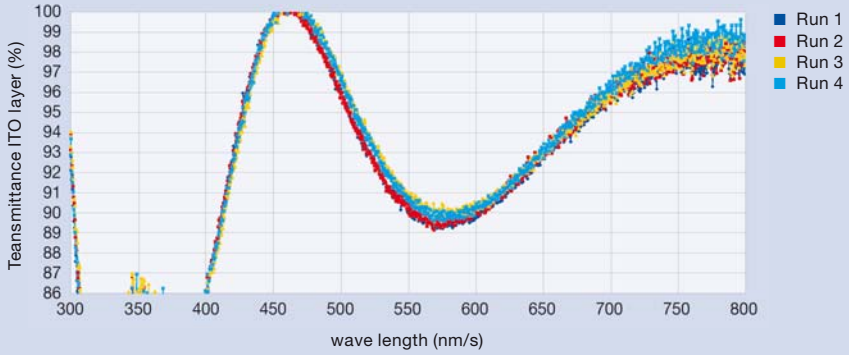
Cycle time:	approx. 2 hours
Substrate diameter	3-segment calotte
2 inch	39 wafers/hour
4 inch	12 wafers/hour
5 inch	9 wafers/hour
6 inch	4 wafers/hour

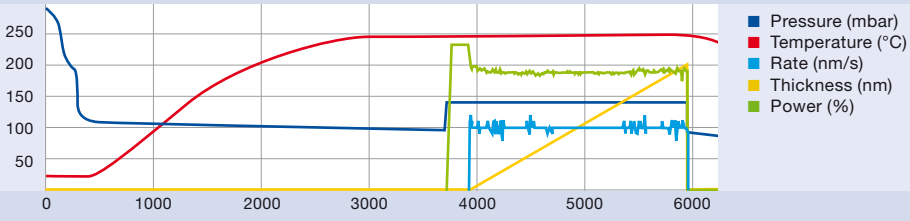
BAK 641

Relative transmission uniformity (200 nm)



Relative transmission uniformity (260 nm)





Process sequence diagram

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Left: top view layout
Right: front view layout