

## Outline

- ❖ Introduction : state-of-the-art, nodule formation
- ❖ Bonded cast-Si targets as an alternative
- ❖ Internal lab evaluation of cast-Si targets
- ❖ Industrial applications:
  - I. c-Si solar cells,  $\text{SiN}_x$ :H coatings
  - II. Touch sensors,  $\text{SiO}_2$  coatings
- ❖ Cost comparison for glass coating example ( $\text{SiO}_2$ )
- ❖ Conclusions

## State-of-the-art; nodule formation

### Rotary Si targets: what's the problem ?

State-of-the-art uses non-aluminium alloyed (B-doped)  
plasma sprayed Si targets.

Such targets have a tendency to form nodules easily:



Plasma sprayed Si targets used  
in  $\text{SiO}_2$  deposition process  
(display industry)

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## Bonded cast-Si targets as an alternative

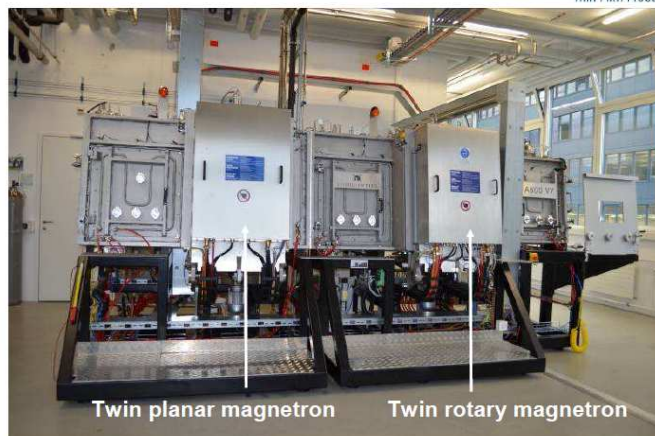
### Product characteristics

Multi-segment, bonded cast-Si rotary targets

- BT: Ti (re-usable)
- Si characteristics:
  - Purity (not including B, C, N, O) : 5N  
(max. 10 ppm metallic impurities, ICP-MS)
  - Density:  $\geq 2.32$  g/cc ( $> 99.5$  % of TD)
  - Poly-crystalline (relatively coarse micro-structure)
  - B-doped, resistivity  $< 20$  mohm.cm (DIN40435, 4-point probe measurement)
- Segment characteristics:
  - Wall thickness: 14 mm (up to 20 mm possible)
  - Segment length: typic. 250 mm
  - ID: 135 mm
- Targets are recycled at end-of-life

## Lab evaluation of cast-Si targets

### AT Lab Balzers, FL: UTTU sputter system



UTTU: Umicore Target Testing Unit

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## UTTU characteristics for dielectric depositions



- Leybold Optics A600/V7: dynamic glass sputter coating line.
- Twin rotary cathode used : SCl end blocks, LO magnet arrays, target length 2 X 0.6 m equipped with cast-Si targets (14 mm wall thickness).
- MF-AC sputter power supplies: Advanced Energy PEII (2 X 10 kW in M/S)
- Arc control unit activated ( $V_{trip} = 155$  V,  $Arc_{off}$  time = 240  $\mu$ s)
- System doesn't dispose of any negative feedback control (no PEM or voltage control). Hence, processes with hysteresis must be run in poisoned mode.

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## Long duration test in UTTU



**Target surface aspect after 6 h  $SiO_2$  reactive deposition test with 9 kW (15 kW/m) in poisoned mode (325 V), pressure 5.6  $\mu$ bar.**

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## **Industrial applications:**

### **I. C-Si solar cells: SiNx:H deposition**

Tests at Photovoltech N.V., Belgium (Dr. J. szlufcik, S. Janssens)

## **Industrial applications:**

### **II. Touch Sensors: SiO<sub>2</sub> deposition**

Tests at an undisclosed Asian manufacturer

## Cost comparison: sprayed vs. cast