

# 8<sup>th</sup> Workshop on Metallization & Interconnection for c-Si solar Cells (MIW 2019)

## Topic 4: Multiwire interconnection has come of age. Flat Ribbons will disappear.

- Tendency of the market
  - More interconnections in order to use less Ag paste for cell cost reduction
    - Big gain between 4 and 6 interconnections, benefit then more and more limited
  - MBB « 12wires » in most of the communications, especially in China.  
Low Ag deposit & Very low impact of finger interruptions
  - MBB and SWCT significantly different –
    - Lowest deposit for SWCT; Interest of no busbar for rhoC on HMJ cell;
    - No alignment for SWCT
  - Influence of the cell technology:
    - MBB suitable for Homojunctions cells, not compatible with Low T° pastes
    - Only SWCT compatible with Ag printed SHJ cells
    - Different constraint in case of plating
- Ribbons glueing also compatible with low silver deposit
  - Quasi-busbarless-cells similar to the cells dedicated to MBB
- Similar module power for MBB, SWCT and structured ribbons glueing (ECA)

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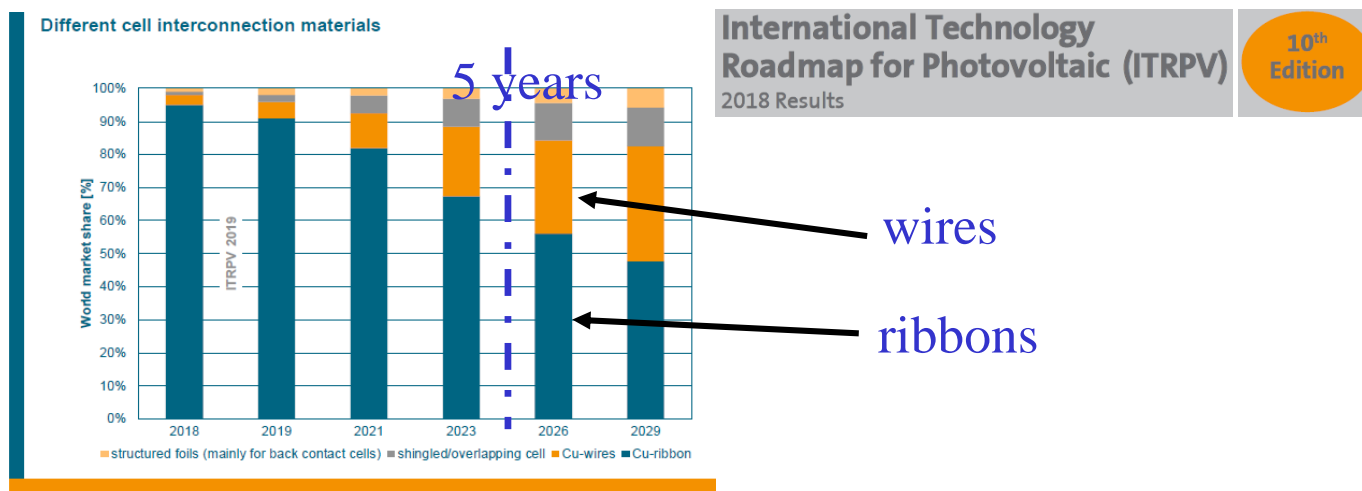
- Rectangular ribbons or round wires
  - Ribbons thinner than wires for a given section => encapsulant thicknesses (however limited impact on the module cost)
  - Mechanical resistance of small wires;
  - How to handle very small ribbons?
    - Ribbons 0,6mm wide OK, especially for ½ cells
    - Limitation to 8 ribbons
- Stress transferred by the wires to the cells => Module reliability
  - Influence of the wire diameter
    - Half-cells compatible with small wires (Ø 0,2mm enough)
  - MBB: excellent paste adhesion required for the soldered pads.
- Effective shadowing size;
  - Round wires
  - Structured ribbons (minimum size) or Structured films glued on flat ribbons

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### Conclusion of the topic 4 discussion:

- Flat ribbons will probably disappear **but not before 5 years.**



- For Homojunction cells MBB will become mainstream; SWCT?
- SWCT will become mainstream for SHJ cells and for IBC cells
- other opinions: Ribbons will never disappear;  
PV will be segmented by a lot of interconnection technologies including Shingle => Topic 5

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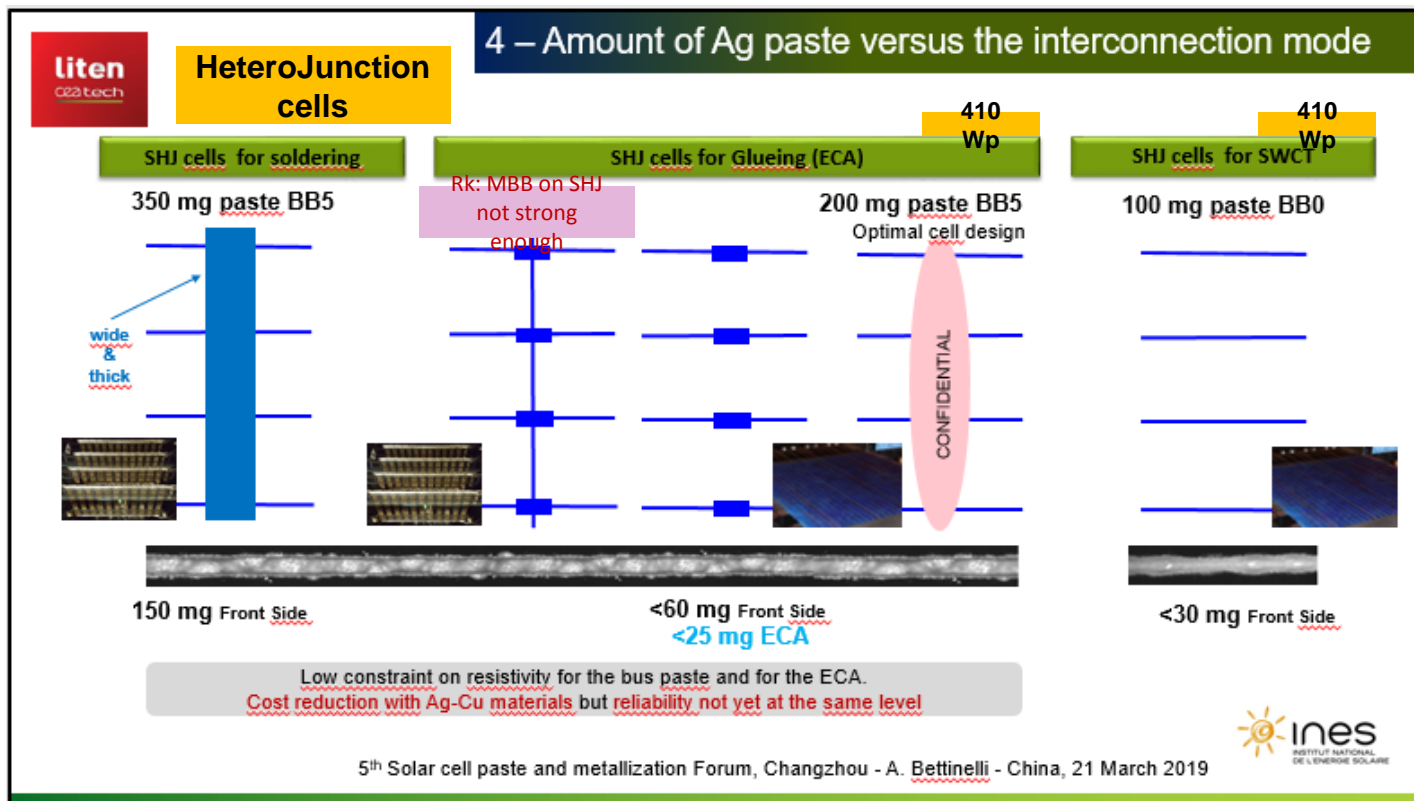
## Annex Topic 4: Wires versus Flat Ribbons

Technology	Trends - Pros	Issues - Cons
Multi Ribbons	Nb of ribbons increasing 5-6 Interest of ECAs	From 7-8 up very low efficiency increase. <b>Limited efficiency and Ag content (Cell+module) reduction potential</b>
Multi-wire (SWCT)	MBB fr HMJ cells SWCT dapted to HJT cells No alignment problems Good optimum for Ag content reduction- Suitable for for IBC	<b>Foils remain more expensive technology MBB not reiable with HJT Cells</b>
MBB - Multi busbar (>=10) Round wires	Reduction of silver Applicable to full cell, mainly HomoJunction Round wire 0.25-0.4mm for full cells	Not really necessary for half cells, Round wire 0.2 enough Difficult to handle ( <b>alignments and breakage</b> ). Equipment efficiency reducing <b>Structured flat ribbon with ECAs shows same optical losses with less mechanical stress on cell</b>
Multi flat ribbons (6-8-10)	Quite easy to manipulate if width $\geq 0.6$ mm. Remains straigth with half cells. => Half cells 6 x 0.6mm Opportunity for IBC cells +ECAs	<b>Still relevant shadowing with narrow ribbons</b>

**Multiwire interconnection has come of age for HJT/Full & Half cells.**  
**Flat Ribbons will not disappear in short term at least with HMJ,**  
**Structured adhesived ECAs technologies with 6-8 ribbons**

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## Annex Topic 4: Specificities of SHJ cells (Low Temperatures pastes)



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## Annex Topic 4: Module reliability considerations; Specificities of SHJ cells

