Design Rules For Solar Cells With Plated Metallization

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MOTIVATION

Advantages of the direct plating process for front-side metallization:
- Narrow finger width (20 µm)
- Silver-free conducting layer
- Low contact resistivity
- No high temperature contact formation steps required
- No damage of sensitive passivation, e.g., PassDop
- Self aligned process

RECOMMENDATIONS FOR PLATING ON PASTE

Baseline process
- Avoid paste corrosion:
  - Use electrolytes with pH>2
  - High glass content
  - good adhesion
  - high FFO temperature
  - good contact resistance
- Low porosity seed paste hinders electrolyte access to glass
- Inhomogeneous plating on paste
  - Avoid glass regions on printed paste surface (e.g., by surfactants)

For best results
- Fine line screen printing result in Ag consumption <10 mg silver/cell
- Creating the conductive layer by Cu-plating is a cheap alternative
- With screen printing sharp contours are hard to achieve
- Using pastes with less bleeding

RECOMMENDATIONS FOR DIRECT PLATING ON SI

Baseline process
- Adhesion
  - 355 nm ps-Laser best option for adhesion
  - Full stack plating + subsequent anneal

For best results
- Account for ARC thinning by HF-Dip already during deposition
  - (75-80 nm instead of 70)
- Low N can be contacted, improves blue response of cell
- Adjustment of BSF formation freely possible
  - full Voc potential yield

General plating rules
- Unequal plating thickness on busbar and finger due to unequal area ratio
- Working with shielding or wire anodes
- Single sided plating
  - Elimination of metal deposition on the rear side
  - Protection from rear side paste attack

SUMMARY

- Many design rules are not only beneficial for plated cells in general
- Most recommendations are already standard in production
  - Increasing the conductive layer with plating is a cheap alternative

Implementation of plating is not as hard as many fear!

References

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