CHEER-UP: Low Cost High Efficient and Reliable UMG PV cells

Carlos del Cañizo
Solar Energy Institute
Universidad Politécnica de Madrid, Spain / carlos.canizo@upm.es

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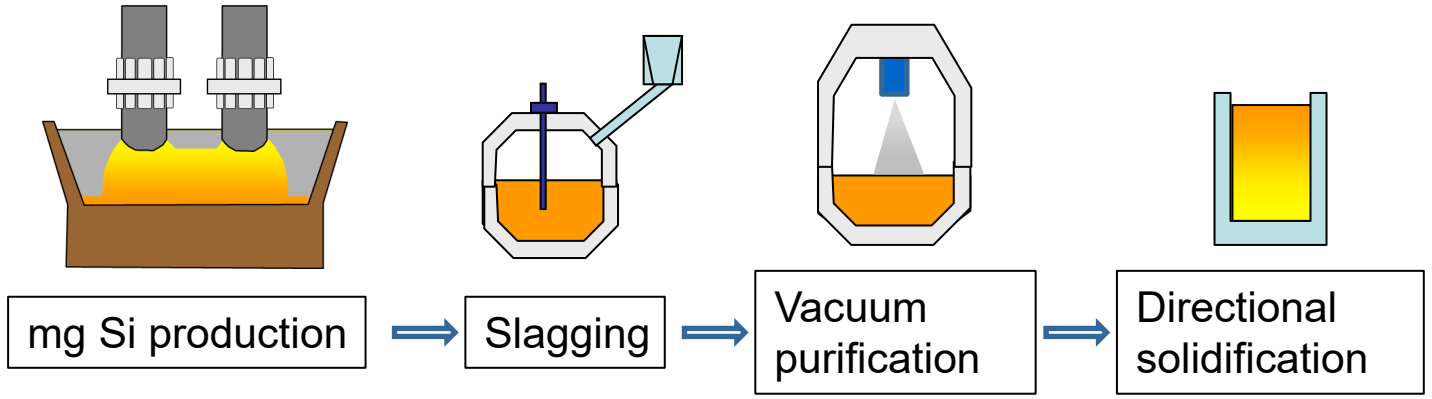
Challenges addressed by CHEER-UP

- Upgraded Metallurgical Grade Silicon (UMG): production of pure silicon for the solar industry by “metallurgical-type” processes



- It offers lower production costs, lower CAPEX (and thus faster capacity expansion) and lower environmental impact, compared to incumbent Siemens technology… at the price of lower level of purification

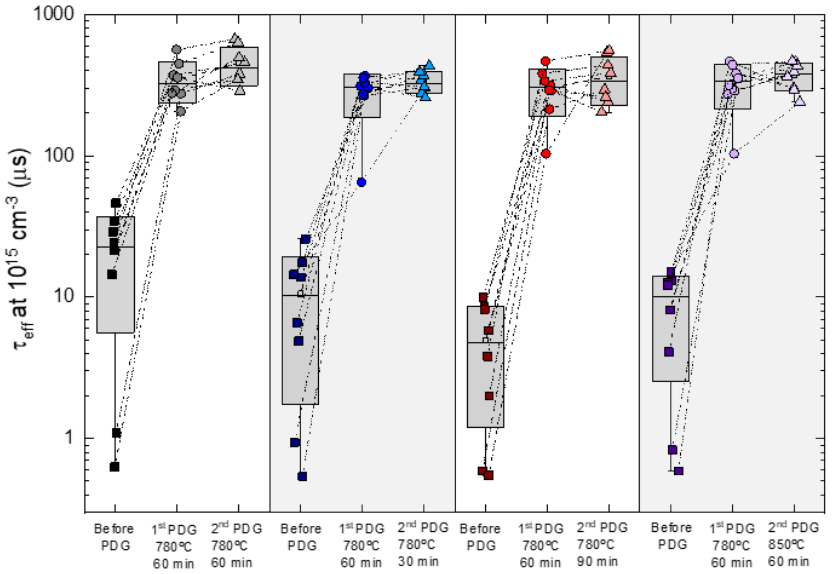
Challenges addressed by CHEER-UP (II)

- Characterize in depth the UMG silicon manufactured by Ferroglobe and understand how to improve the material quality during solar cell processing
- Demonstrate high efficiency PERC solar cells on UMG Si by industrially-compatible processing, incorporating defect engineering, advanced passivation and nanotexture
- Assess the potential of UMG as a substrate of advanced cell architectures
- Do not discard UMG yet, it can provide important benefits to a European solar industry!

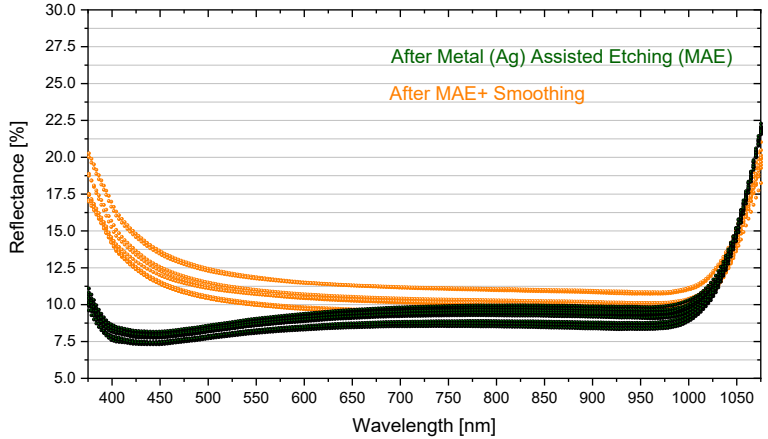
Key outcomes, results and benefits

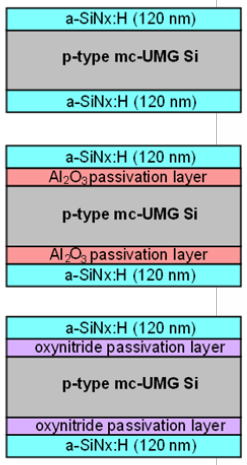
- Better understanding of material specificities

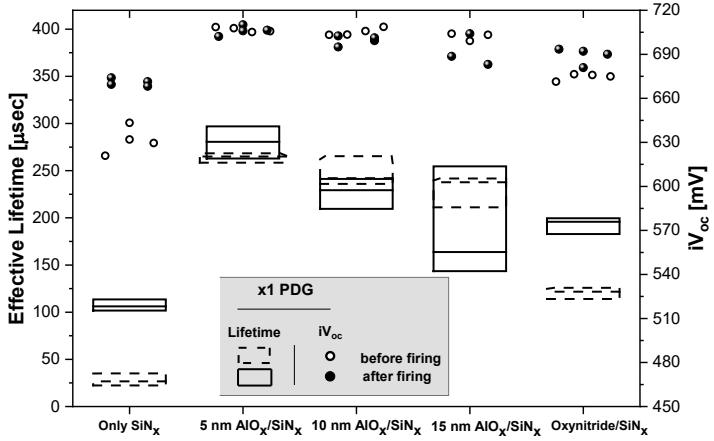
Lifetimes raised to >300 µs, even 700 µs!



Metal assisted nanotexturing giving reflectivities ~10%!



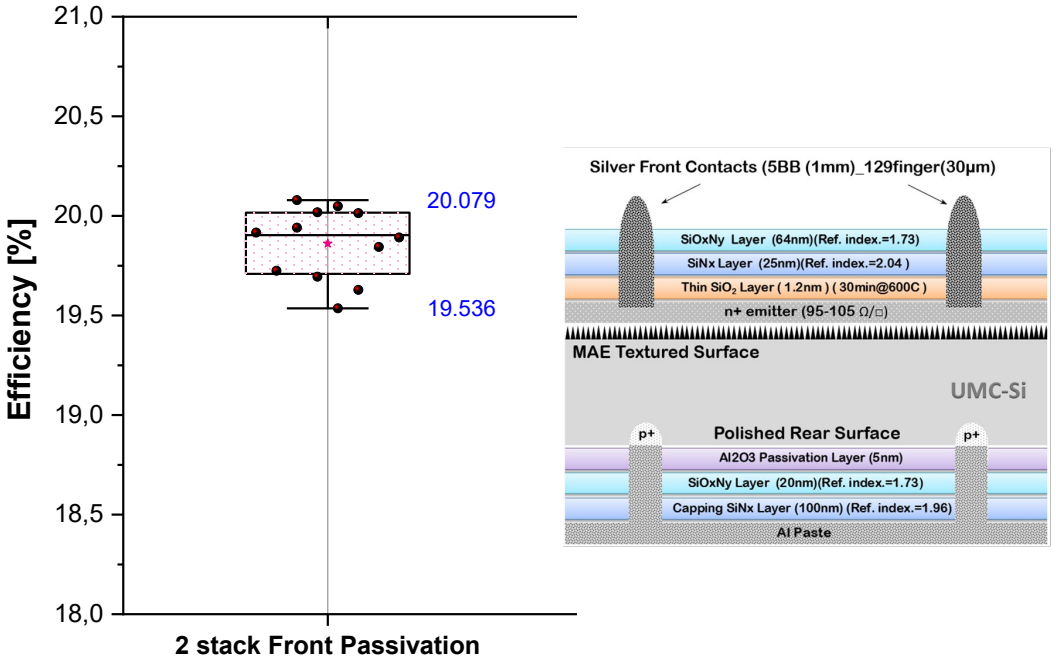




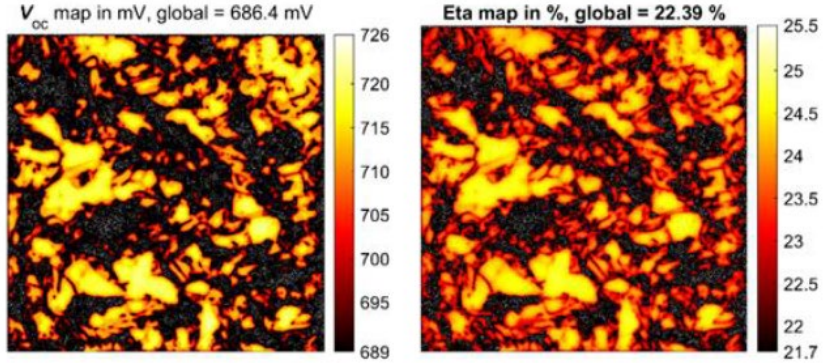
Excellent surface passivation up to iVoc 700 mV!

Key outcomes, results and benefits (II)

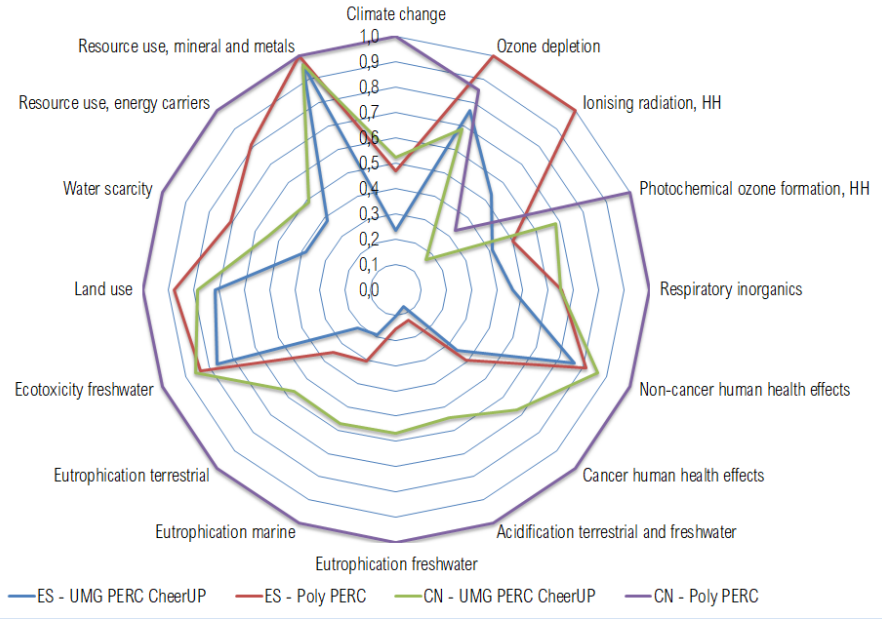
- High efficiencies, low environmental impact



PERC solar cells efficiencies of ~20,1%, not limited by material quality



Potential of >22% in TOPCore solar cells



LCA analysis reveals UMG performs better than conventional polysilicon in different manufacturing places

Experiences gained in transnational set-up

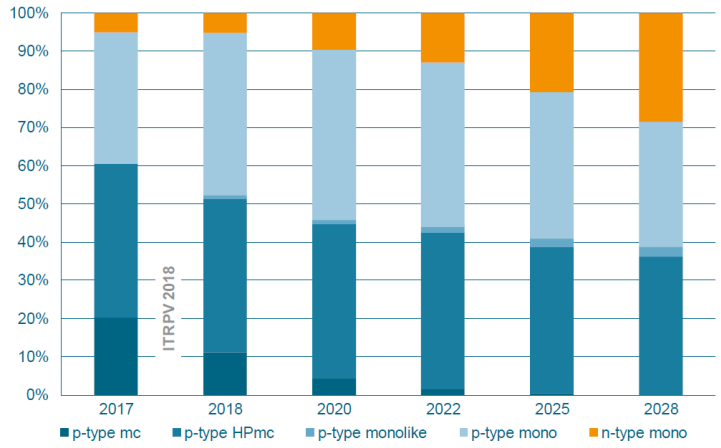
- This call allows research objectives to be addressed by smaller consortia than in large European projects, allowing greater focus and greater agility
- To establish smooth collaboration dynamics takes time and effort
- If successful, these collaborations are fruitful and can be maintained for long
- It is important that the role of each partner is clear at the start of the project, but flexibility is required to address contingencies
- The consortium is enrichen with the complementarity of universities, research centres and companies

Critical factors and lessons learned

- The long time elapsed from the conception of the project to its kick-off makes it difficult to really impact in the field and strengthen the competitivity of the partners

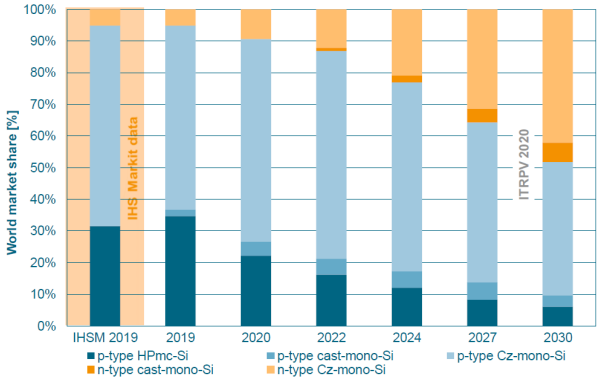
  1st proposal submitted in October 2018. After two stages in the European decision process and a third one in three different funding agencies, the project began in February 2020.

The UMG material was grown multicrystalline.



ITRPV 2018 – Trends in wafer-type share

In 2020, the prospects for multi-Si were much worse



ITRPV 2020 – Trends in wafer-type share

In 2023, multi-Si has been expelled from the market.

Thank you for your attention

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