European Photovoltaic Cluster
General Assembly

[Title of Presentation]

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CEA

AGATHA Project

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With the support of the European Union

AGATHA project

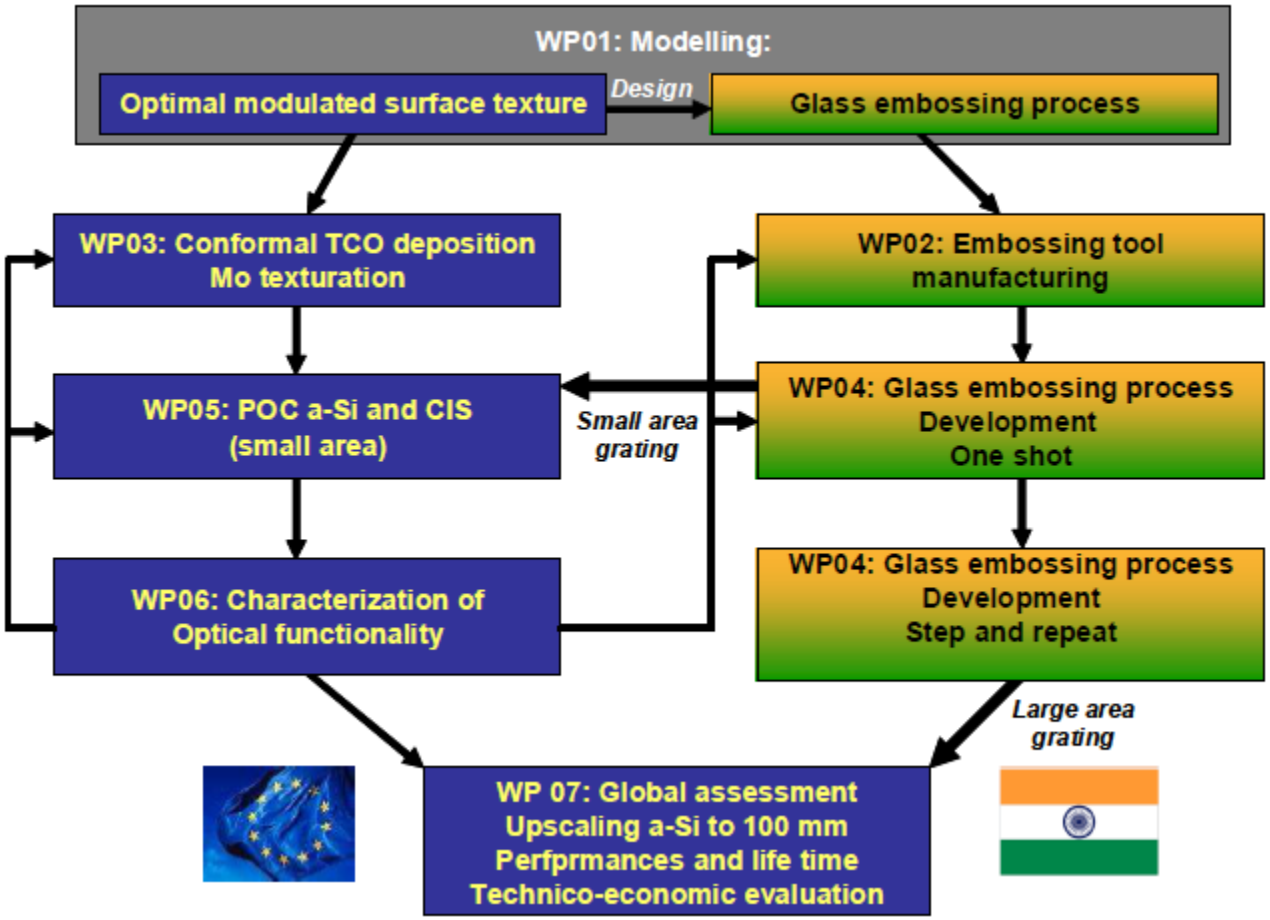
- **A**dvanced **G**r**a**tting for **Th**in films sol**a**r cell : AGATHA
- Funded under FP7-Energy India collaborative call
- Start 10th of Sept. 2010 – end 31st of Aug. 2016
- 3 years delays due to EC/DST coordination agreement (Kick-off meeting Sept. 2013)
- http://agatha-project.eu/

- SUMMARY

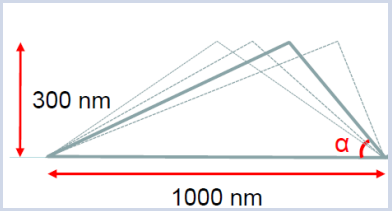
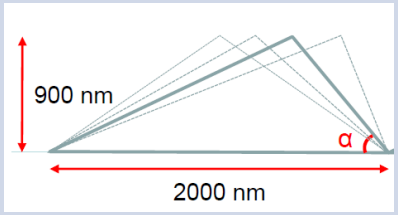
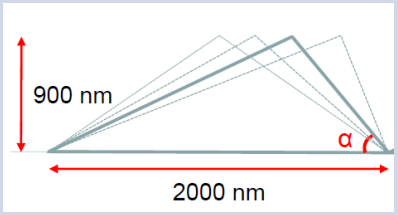
➢ AGATHA project aims at reducing absorber thicknesses in different thin-film technologies: a-Si:H (decrease of Staebler Wronski effect), µC-Si:H (reducing deposition time) and CIGS (reducing In consumption) while maintaining performances (particularly J_{SC}) by using **textured glass substrates** for light trapping in solar cells

➢ Cooperation between **India** (glass substrates texturation by embossing) and **Europe** (double texturation + thin film solar cells fabrication)

AGATHA project



Objectives

Technology	a-Si:H	µc-Si	CIGS
Thickness reduction	300 -> 150 nm	1600 -> 1000 nm	2500 -> 600 nm
Quantitative objective	Jsc = 17 mA/cm2	Jsc = 24 mA/cm2	Jsc = 30 mA/cm2
Advanced gratting	Embossed glass  + Chemically etched TCO	Embossed glass  + Chemically etched TCO	Embossed glass  + Mo nanoparticles

TRL 2/3 : beginning of project
Concept + solar cells @ lab. scale

TRL AGATHA

TRL 4 : end of the project
mini-module (7x7 cm2) fabricated

Main results and bottelnecks

- Difficulty with Indian consortium : no embossed substrates provided during the whole project ⇨ own substrates fabrication in European consortium (additional work and delays)

- Main results obtained so far
  - Fabrication of periodic textured glass substrates @ CEA
  - Deposition methods for ultrathin CIGS solar cells @CEA
  - Fabrication of random textured glass substrates @TUD

- Bottlenecks identified so far
  - Big (300 nm) Mo nanoparticles deposition (@MD) – no interest (simulation results)
  - Ultrathin CIGS deposition on textured substrates (presence of shortcuts)
  - Thin film silicon : better results with flat substrates + chemical etching of front TCO

Conclusion

- Scientific contribution : 2 papers + 3 conferences
- 3 patents deposited @ CEA for substrates fabrication

- Conclusion
  - 3 years project start delayed -> some of research axes are no relevant (thickness decrease for a-Si:H and µc-Si:H : industry is now only focusing on multijunction solar cells) -> objectives have been changed to higher efficiencies with constant thickness
  - CIGS with reduced thickness still hot topic

Future works

- Permitted to European RTO to work on glass texturation
  - Useful for other applications (antireflecting coating, stealth, …)
  - Patents have been deposited

- Results have to be confirmed (few work on solar cells have been done due to time spent on glass texturation

- New substrates and methods to be used in future H2020 project ⇨ texturation methods at pilot scale necessary

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Thank you for your attention

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