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From PV to batteries

Dr Jenny Baker
EPSRC ECR Fellow
Oxford 25.11.2019

info_specific
#ActiveBuildings
#GenerateStoreRelease

Active Buildings

Generate – Store – Release - Monitor

- Opaque PV
- Window PV
- Transpired Solar
- Electrochemical Storage
- Thermo-electrics
- Novel heat release systems

Innovative functional coatings research

- Inter-seasonal storage

- Water saving devices
- Heat Pumps
- Flow batteries
- Solar thermal

Demonstrators

Dye sensitised solar cells

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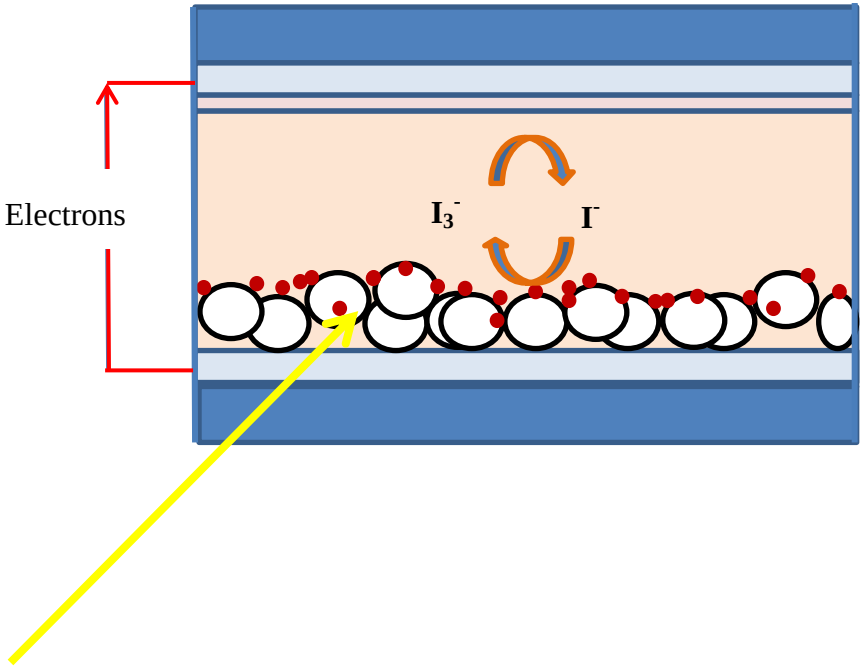
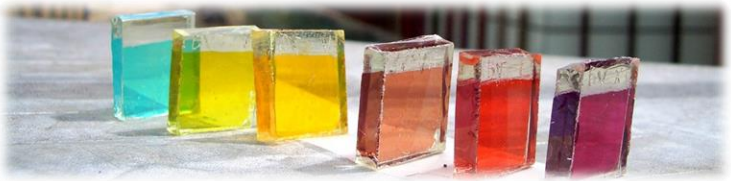
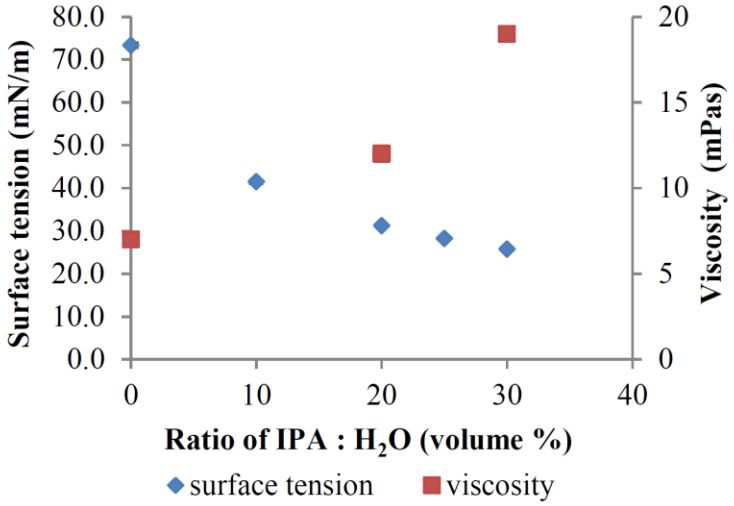
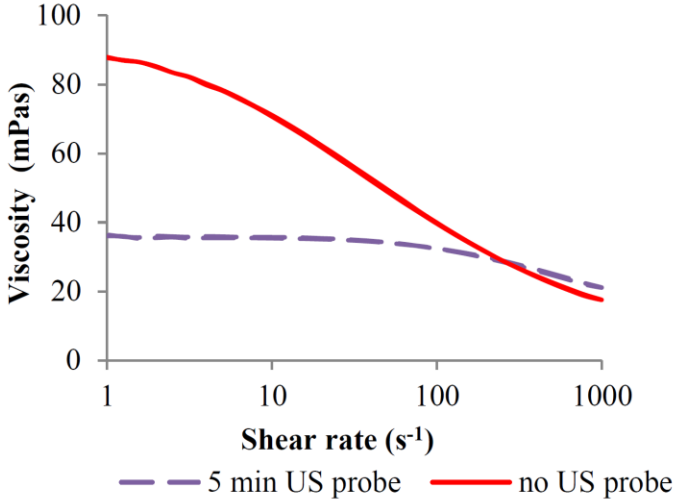


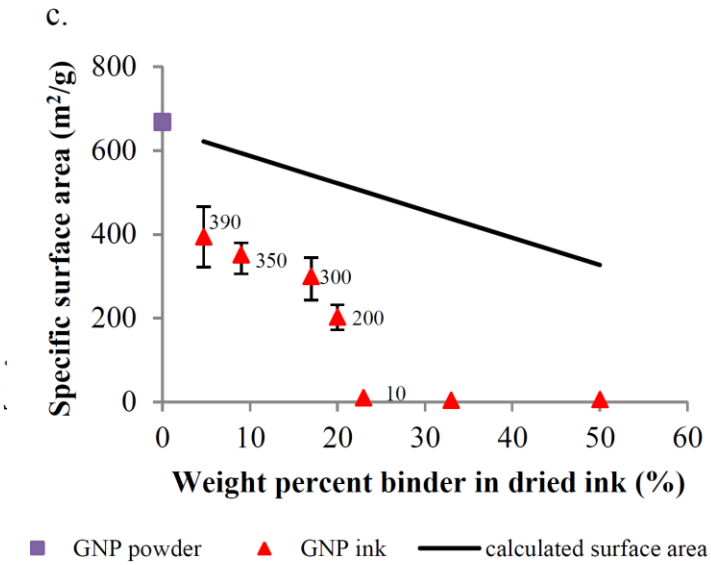


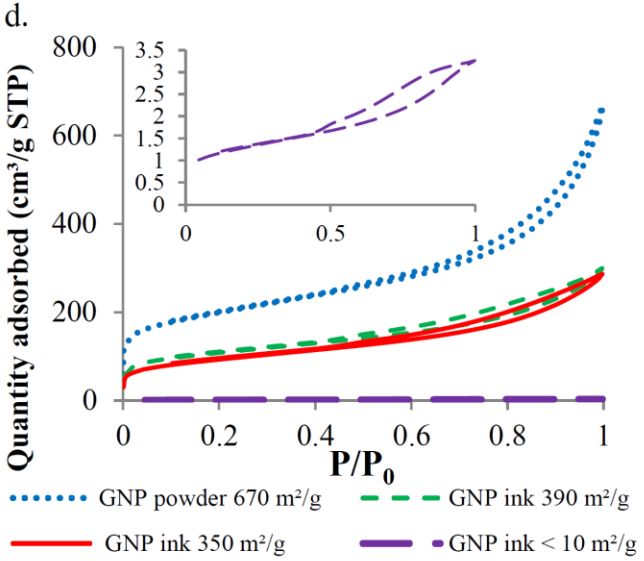
Welsh Centre for Printing and Coating
WCPC
Canolfan Argraffu a Chaenu Cymru

Ink development



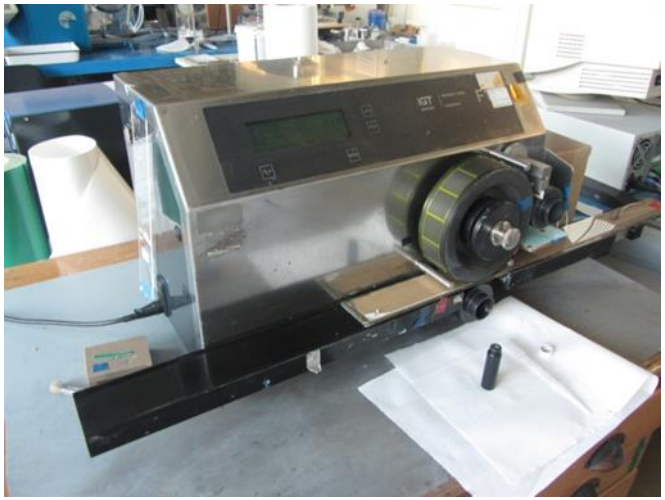


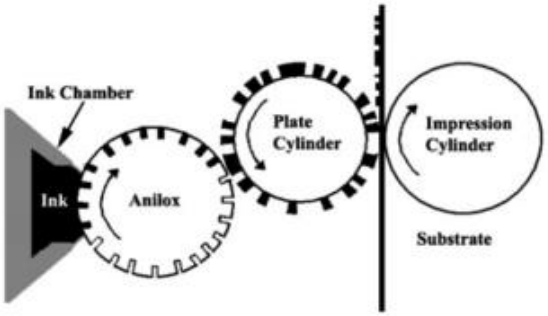




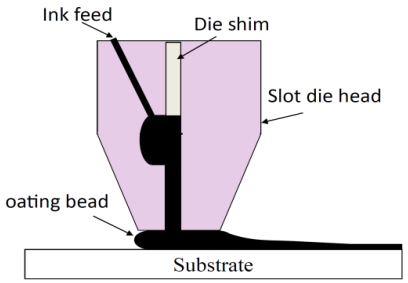
J. Baker,et. al., *Advanced Energy Materials*, DOI:10.1002/adem.201600652, 2017

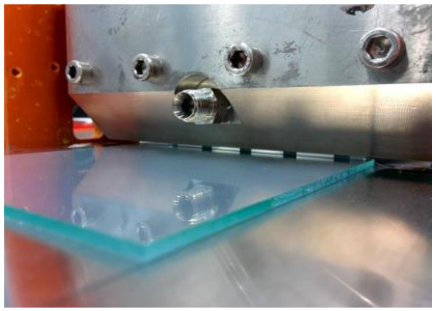
Printing





2D Flexographic printing

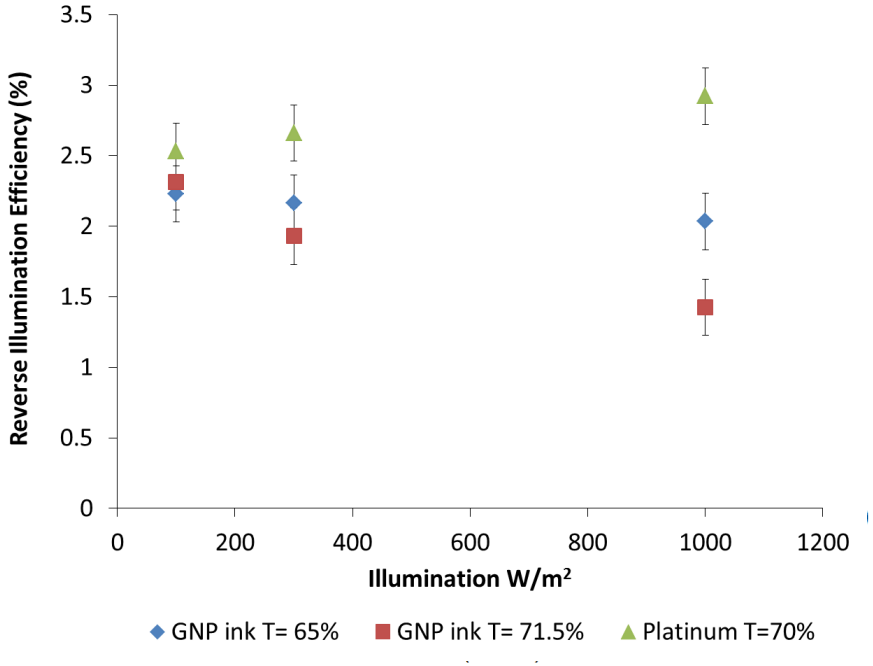


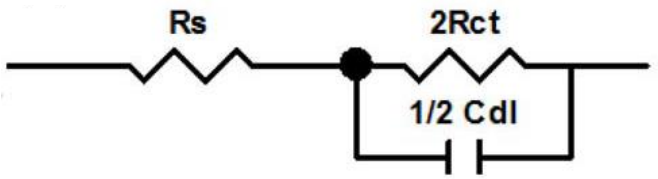


1D Slot die coating

J. Baker,et. al. *Mater. Res. Innov.*, vol. 18, no. 2, pp. 86–90, Feb. 2014.

GNP ink catalytic performance



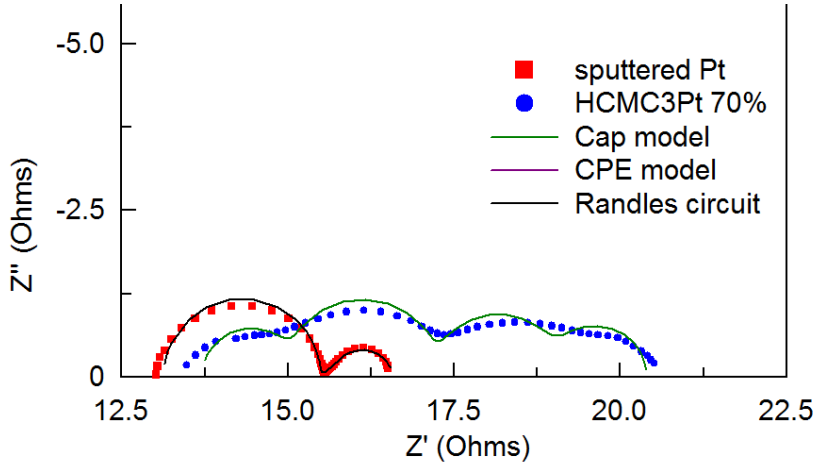


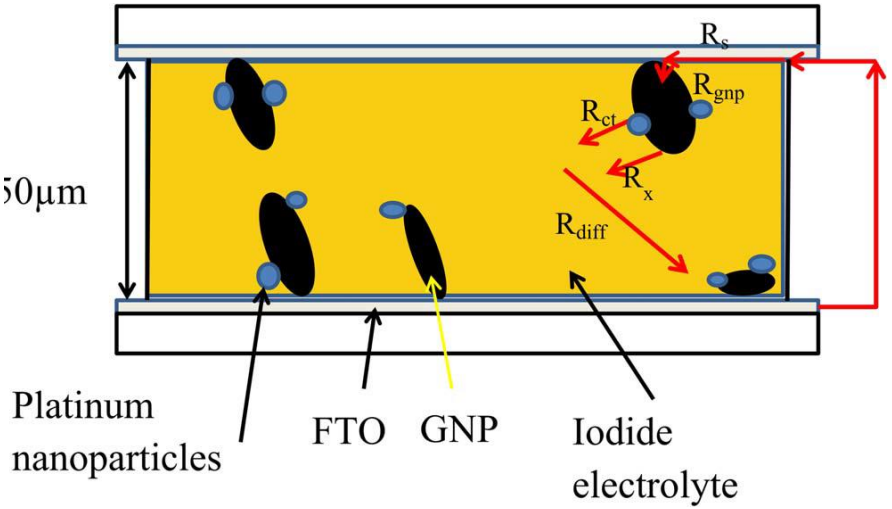
R_{ct} GNP ink ~88Ω/cm^2

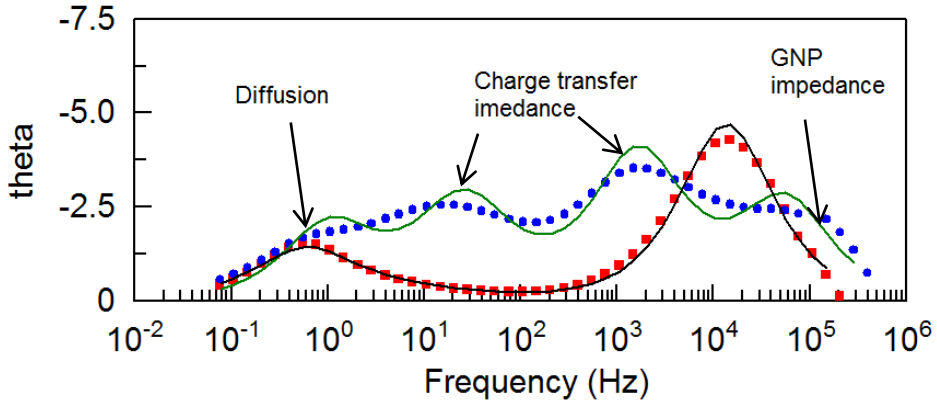
R_{ct} platinum ~ 2Ω/cm^2

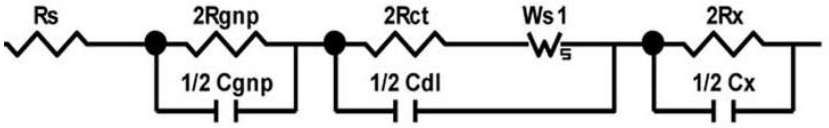
- Thermally reduced H_2PtCl_6
  - Cheap – can use solution from recycled thermocouples
  - 385ºC processing – use GNPs as a scaffold for low temperature deposition.

Impedance of GNP-Pt ink







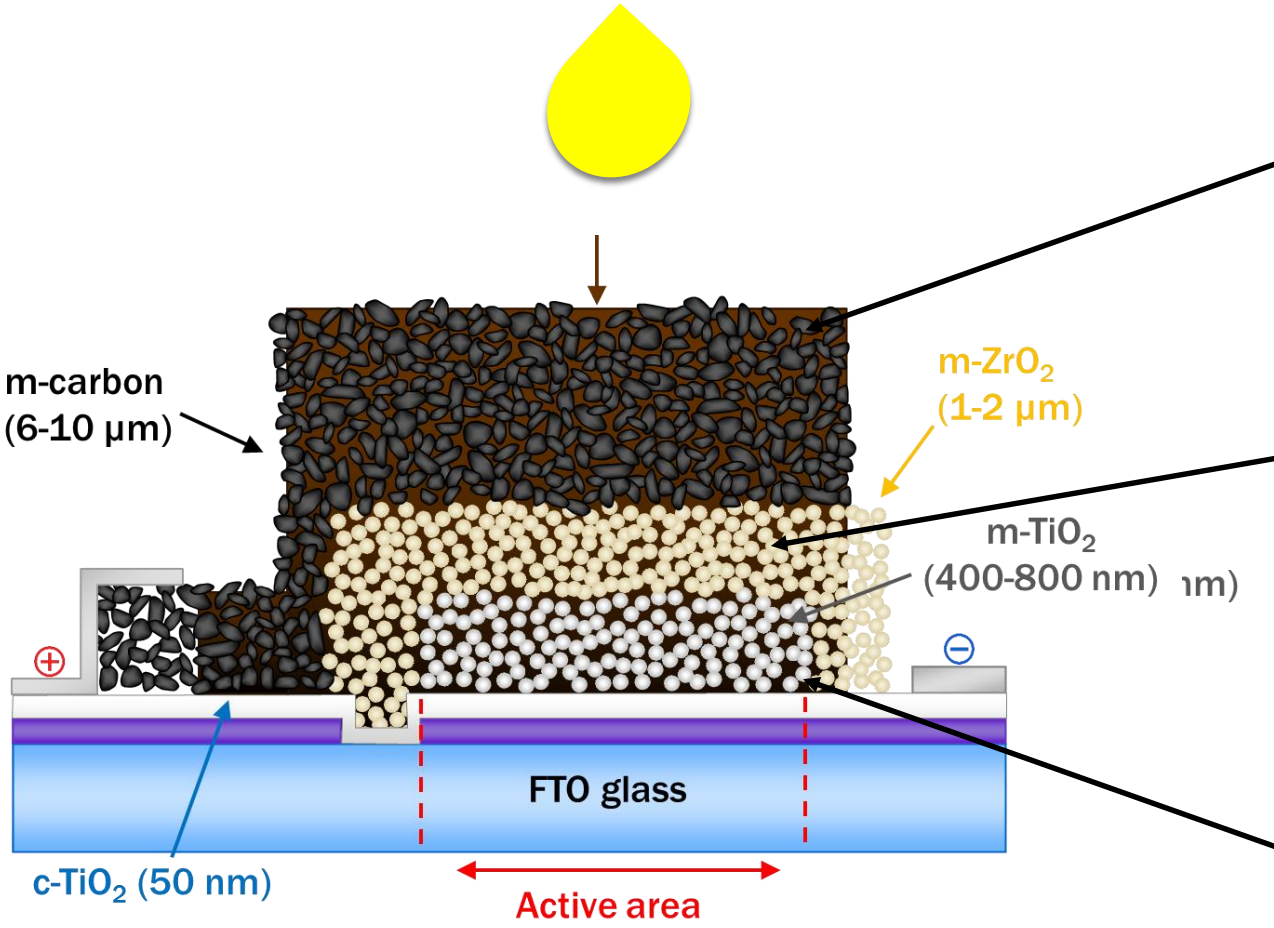


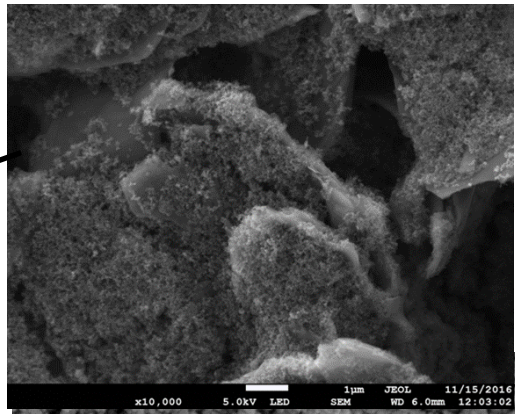
R_{ct} GNP-Pt ink ~5Ω/cm^2

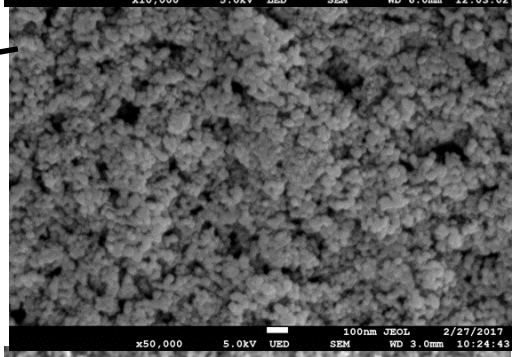
R_{ct} platinum ~ 2Ω/cm^2

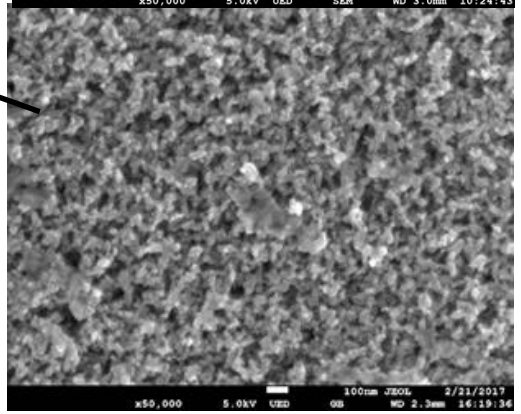
J.Baker et.al. Journal Electrochemical Society 162, (8) H564-H569 (2015)

Mesoporous architecture

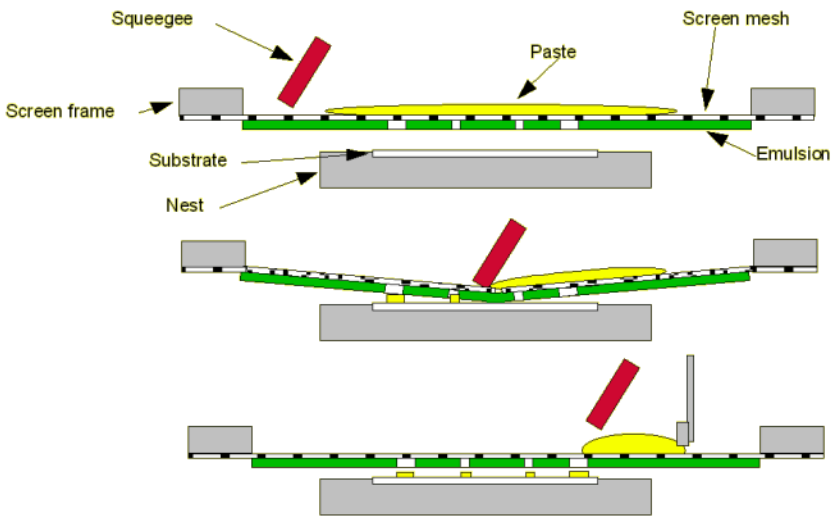


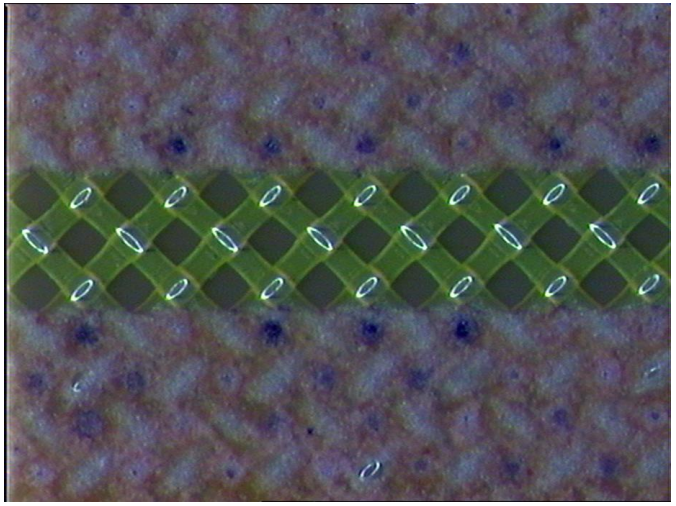






Screen printed layers





90 minutes ➡ 25 seconds

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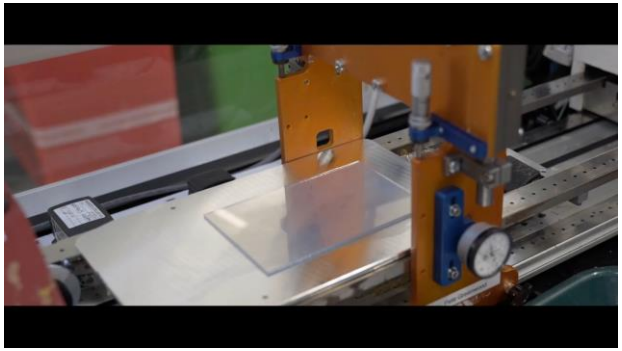
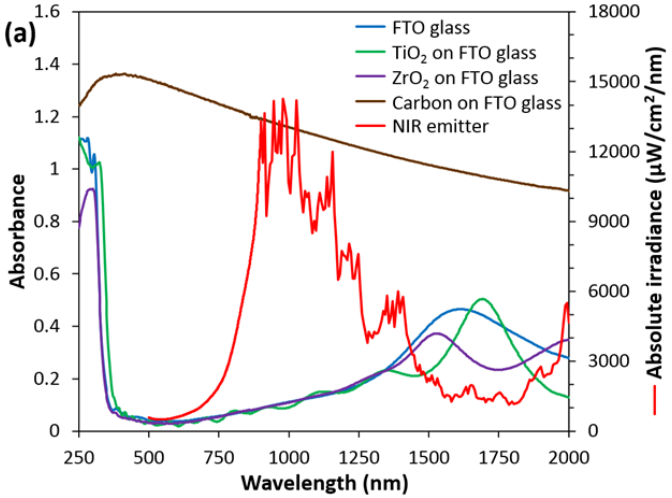
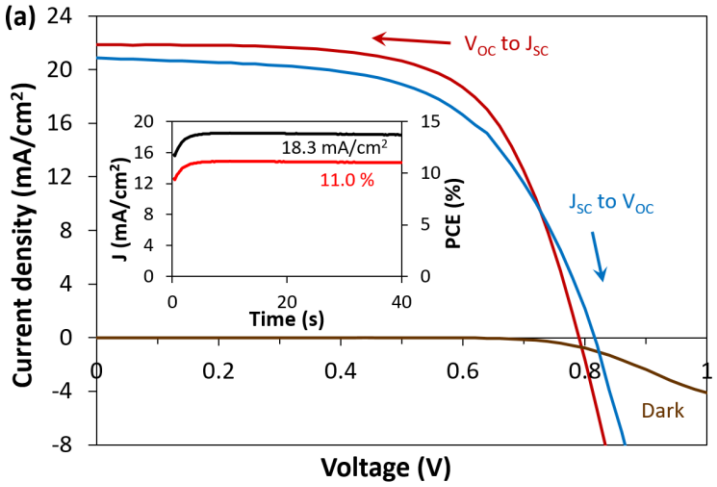
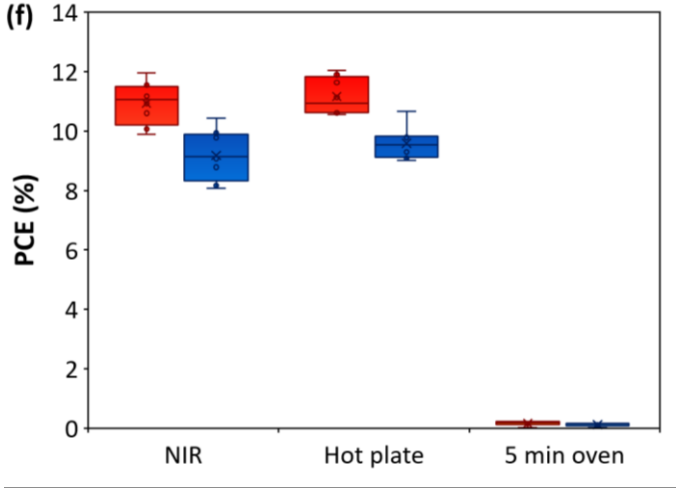


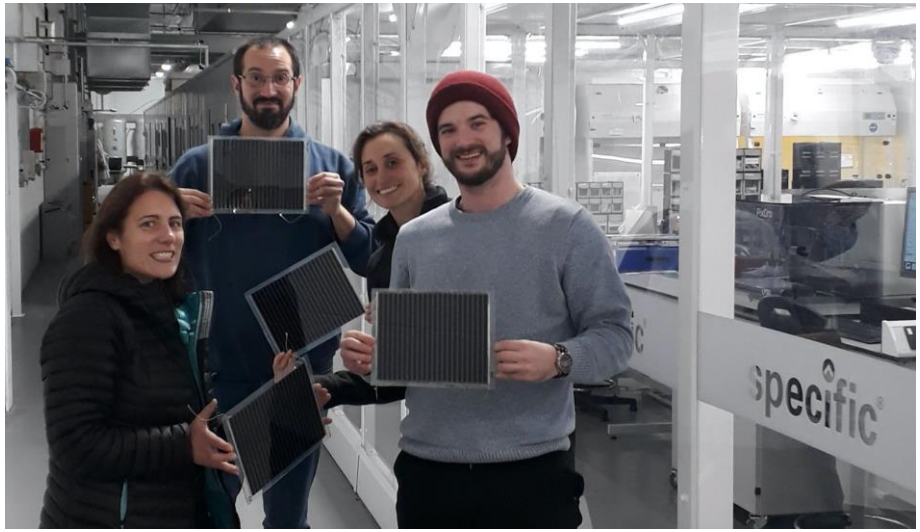


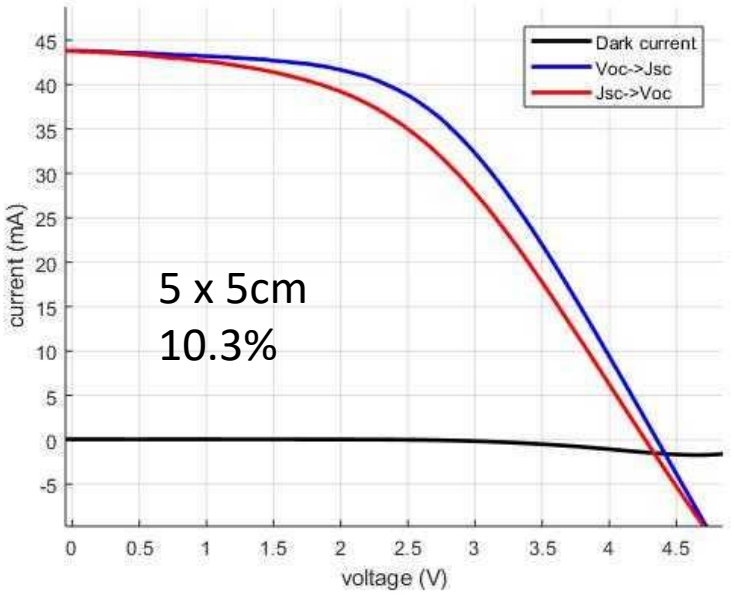


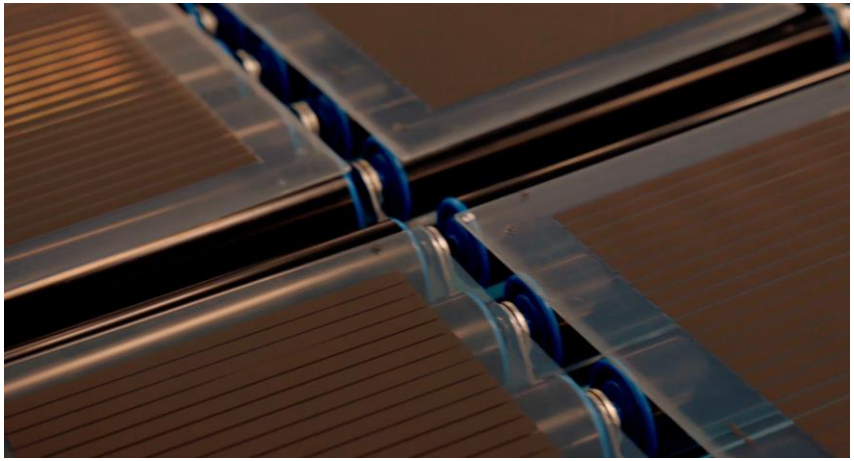


J.Baker, K.E.A.Hooper et.al. Mater. Chem. A., 2017, 5, 18643

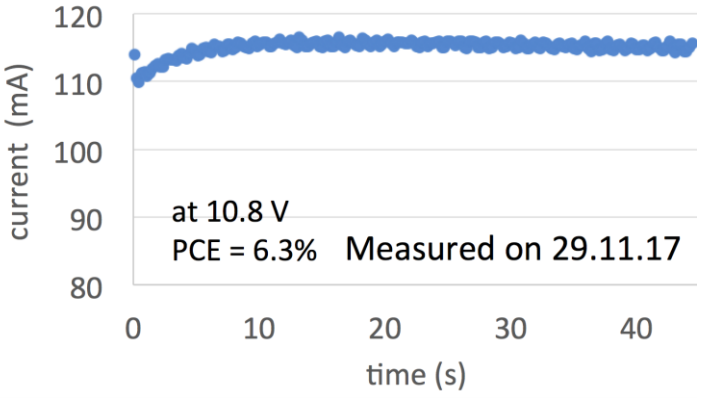
Pilot trial





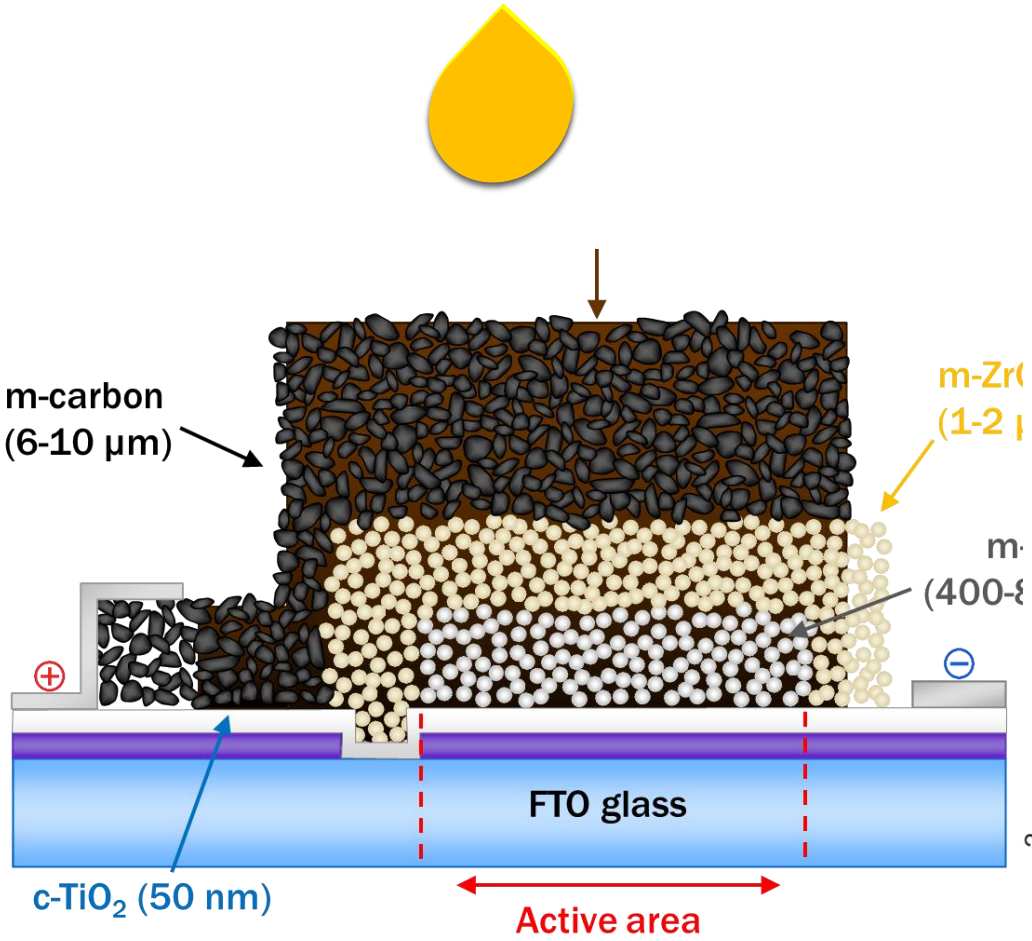


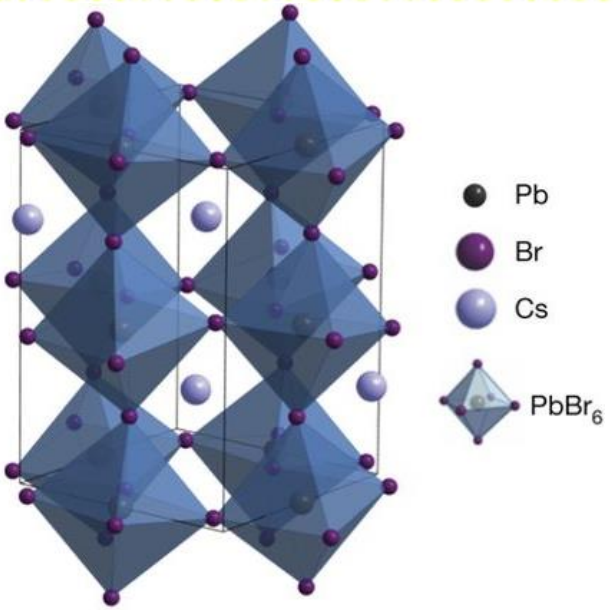
19.8 V_{oc} (22 cells) - **0.9 V_{oc} per cell**

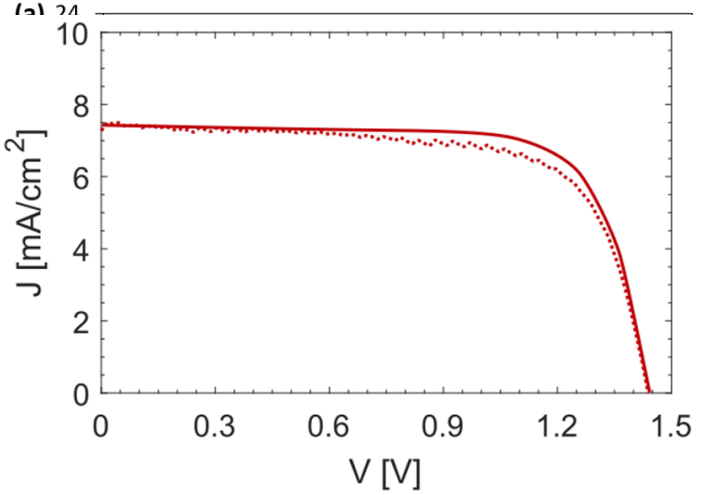


F. De Rossi et. al –Advanced Materials Technologies

Mesoporous architecture



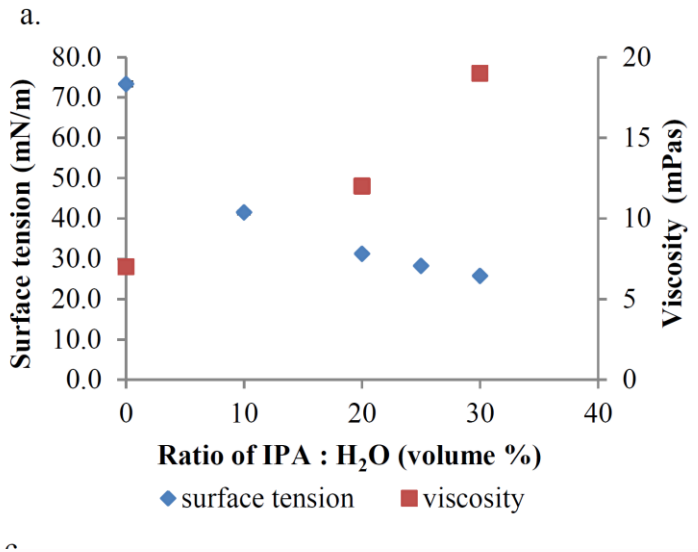




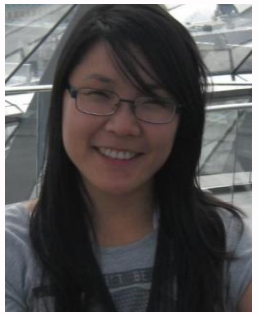
I Poli, et. al –Journal of Materials Chemistry, 2018
I. Poli, et. al, Nature Communications 2019

Current Research

- Focus on NIR heating for carbon electrodes
  - Pore size manipulation
  - Water based slurries and atmospheric drying
  - Co-solvent development
  - Reducing interlayer diffusion



- Assessment of different commercial fixed storage systems
  - Lithium ion
  - Aquion – salt water battery
  - Flow Cells



Dr Guangling Zhao

Thanks

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Dr Francesca De Rossi
Dr David Beynon

Recruitment for a post doc – closes 30th November.

Dr Petra Cameron

Dr Isabella Poli

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