Big data for identifying instability issues in next generation solar cells

COST Action CA16235 Pearl PV

Organized by Working Group 2: Reliability and Durability of PV

Discussion group Introduction

Dr. Mohammadreza Aghaei (TU/e)

Dr. Jeffrey Kettle (University of Glasgow)

2nd February 2021, 09:00h-12:00h (CET)

Presentation by Jesper Jacobsson (HZB)

- Work currently under review in journal
- Video presentation

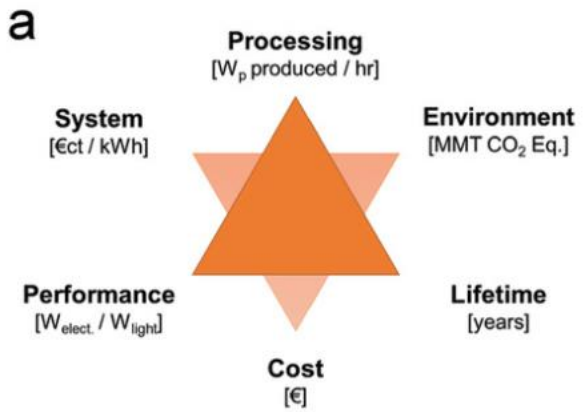
Big data for next generation solar cells - examples

- Prescreening materials such as polymers combined with density functional theory (DFT) calculations
  - Example such as Harvard clean energy project
- DFT has been used in conjunction with ML to calculate the decomposition energies which are thought to correlate with the thermodynamic stabilities of PSCs.
- Yildirim employed data analytical techniques and ML techniques to analyse trends and patterns present in a database reporting on perovskite performance reports between 2013 and 2018
- Sahu *et* al. use an ML approach considering the largest number of parameters that control the properties of OPV materials yielding high efficiencies e.g. Number of unsaturated atoms in the main conjugation path of donor molecules, Vertical ionization potential of donor molecules, Polarizability of donor molecules etc (small number of materials)
- ML has been widely deployed in PV systems. For example, fault detection in PV power station which needs to be rapid and effective and PV power forecasting

Potential ideas

- Is it useful to apply machine learning to large data sets in this manner
  - What are the best attributes to study
  - What provides greatest insight
  - As someone working in the h field, how would you use/interpret such data

- Is it better to seek out how to improve performance or stability
  - Do we optimize both – then how?
- How do account for inconsistency in the data (i.e. measurement protocol)
- Use data from a single group or everyone?



Closing remarks

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Report back from discussion groups

- Group 1; Lead by Jeff Kettle, University of Glasgow and Jesper Jacobson, (HZB) - "Big data for identifying material instability issues in next generation solar cell"

- Group 2; Lead by Mohammadreza Aghae, Eindhoven University of Technology (TU/e) and Christian Braun, Fraunhofer ISE - "Big data for identifying material instability issues in next generation solar cell"

Working group 2: Follow on points

- Short report of todays meetings and discussions to be prepared and shared with participants
- Inviting groups/individuals to participate and work together with the goal of developing joining papers or research grants, or other forms based on discussions made
- Reports available within the next week. Email will be sent to members of WG, please join if you haven't already
- Informally if you are interested, contact Reza or myself and we will direct you

Working group 2: Future plan

- *Review paper to be submitted soon. Addition collaborative papers accepted and published*
- Current: Identification of relevant data to be collected to measure reliability and durability
- Development of a holistic approach of autonomous monitoring for reliability and durability of PV systems using the potential of big data bank and the methods of big data analytics (BDA).
- Sharing knowledge via workshops, seminars and joint publications originating from WG2 with a wider community of PV stakeholders and other experts working for insurers, investors and banks

PEARL COST action

- If not a member, please consider joining https://www.pearlpv-cost.eu/

WG1. PV monitoring
WG2. Reliability and durability of PV
WG3. PV simulation
WG4. PV in the built environment
WG5. PV in grids

- Opportunity to network/find collaborators for papers and grant applications

Future events

- Scheduled events in 2021 (so far)
- 2 February: Online workshop WG2: New approaches for identifying and analysing failures in PV
- 2 March: Online workshop WG4: PV in the built environment - Architects' and designers' points of view
- 5 July: Seminar, Brasov, Romania
- 6-9 July: Training School: Simulation tools and models for the analysis of PV system performance, Brasov Romania, Nicola and Cedric will notify speakers and trainers.
- 4 October: MC5 Meeting, Eilat, Israel
- 5-7 October: Parallel Workshops, Eilat, Israel

Thanks

- Speakers – Prof Kurtz, Dr Alves do Reis Benatto, Dr Owen Bellini, Prof Theelen, Dr Fairbrother
  - many have given up sleep to be present!
- Dr Christian Braun and Dr Jesper Jacobsson
- Dr Mohammadreza Aghaei for WG2 leadership
- Dr Cihan Gercek, University of Twente
- Angele Reinders, David Moser and management team of PEARL
- EC COST for funding
- …many thanks to you for attending and making the discussions a success

Thank You Very Much for Your Attention!

Any questions or final points?

Jeff Kettle & Mohammadreza Aghaei

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https://www.pearlpv-cost.eu/wg/wg2

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