



Industrial roll-to-roll (R2R) printing of highly efficient non-fullerene acceptor (NFA)-based organic photovoltaics (OPV)

Dr. Rui Zhang

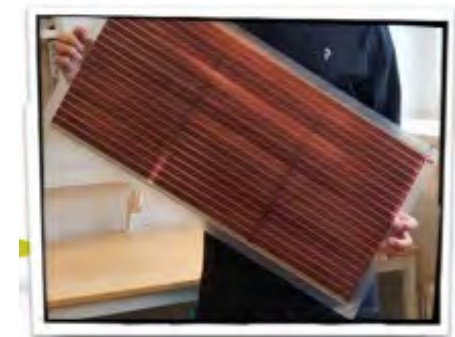
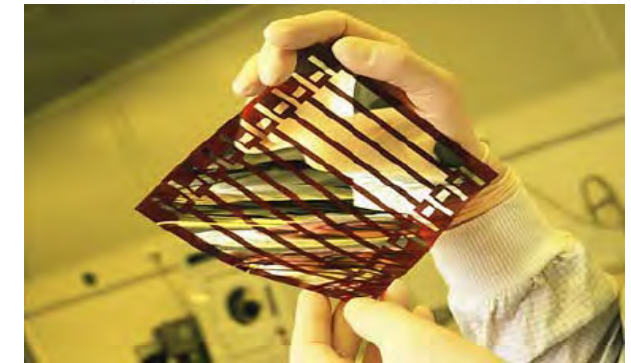
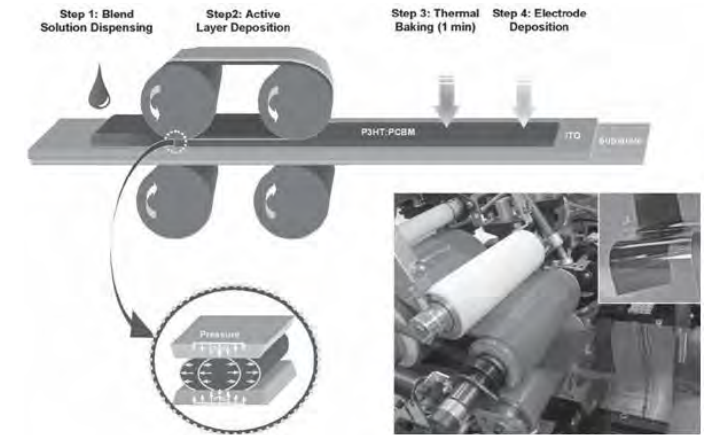
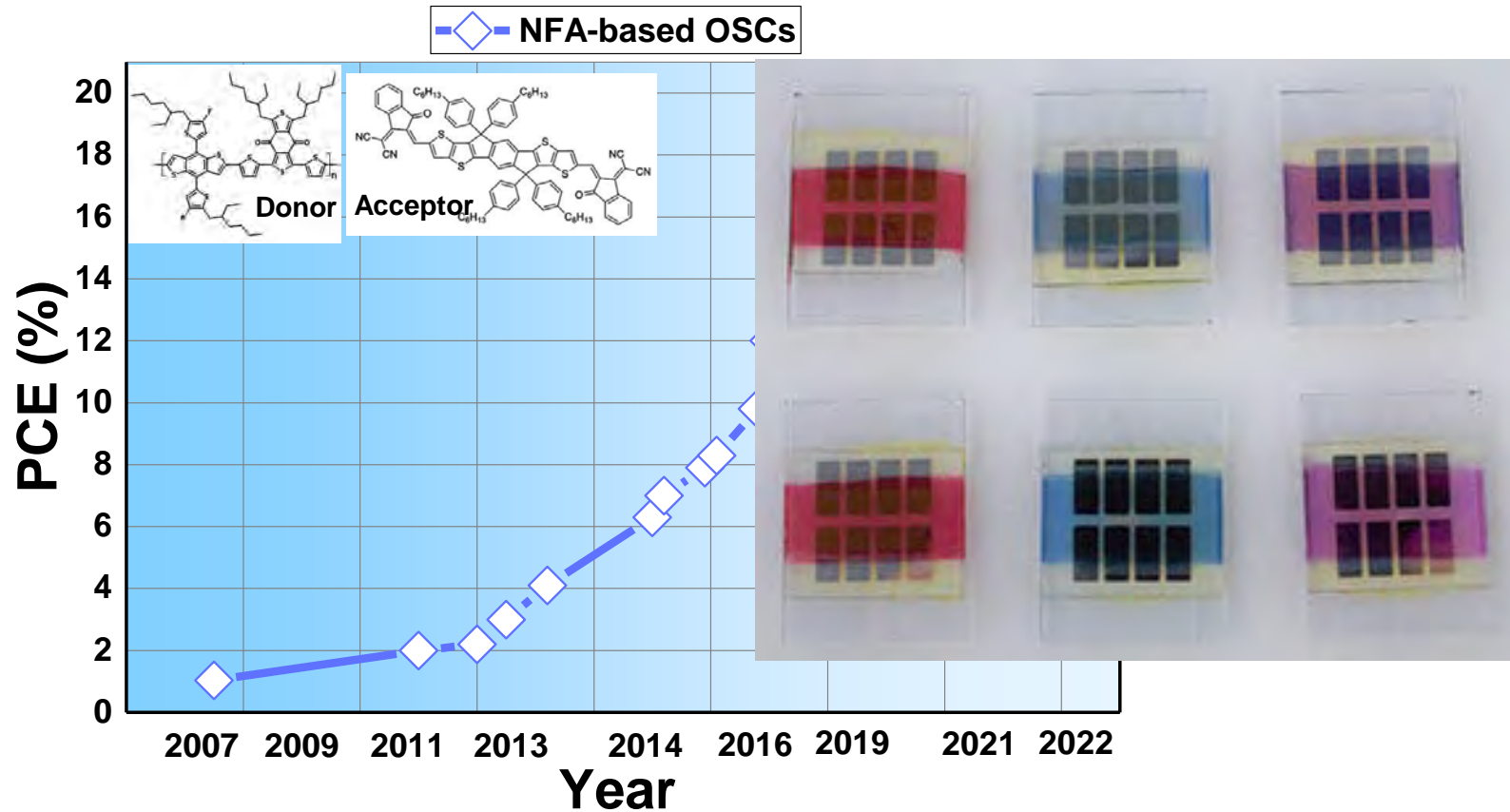
Linköping University

Department of Physics, Chemistry and Biology (IFM),
Linköping University, Linköping 58183, Sweden

Email: rui.zhang@liu.se

« Exchange of Experiences » - Webinar

Insights, outcomes and results – 28 September 2023



- ❑ PCEs drop in environmentally friendly solvents.
- ❑ A big gap exists between lab-sized and commercial devices

« Exchange of Experiences » - Webinar

Insights, outcomes and results – 28 September 2023



Academia



Prof. Feng Gao
Linköping University, Sweden
Major: device physics

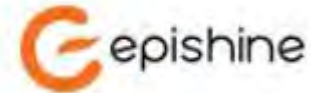


Prof. Eva. M. Herzig
University of Bayreuth, Germany
Major: morphological structures
and optical physics



Prof. Maria Antonietta Loi
University of Groningen, Netherlands
Major: hole/electron transport layer,
lab-scaled device fabricates

Industry



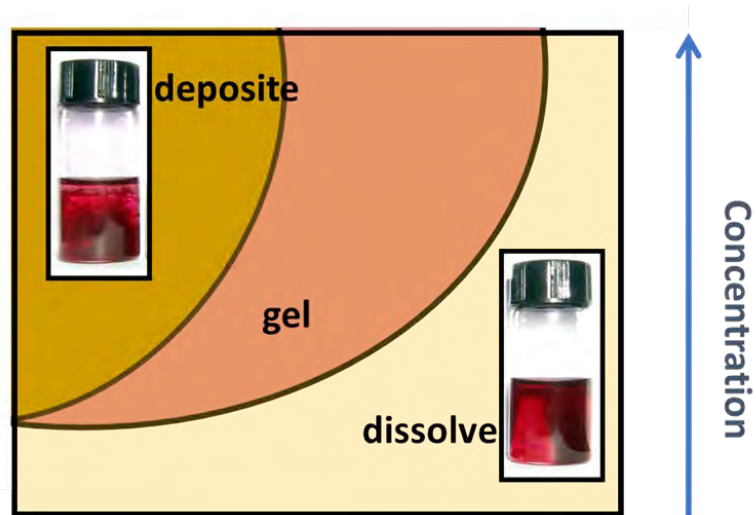
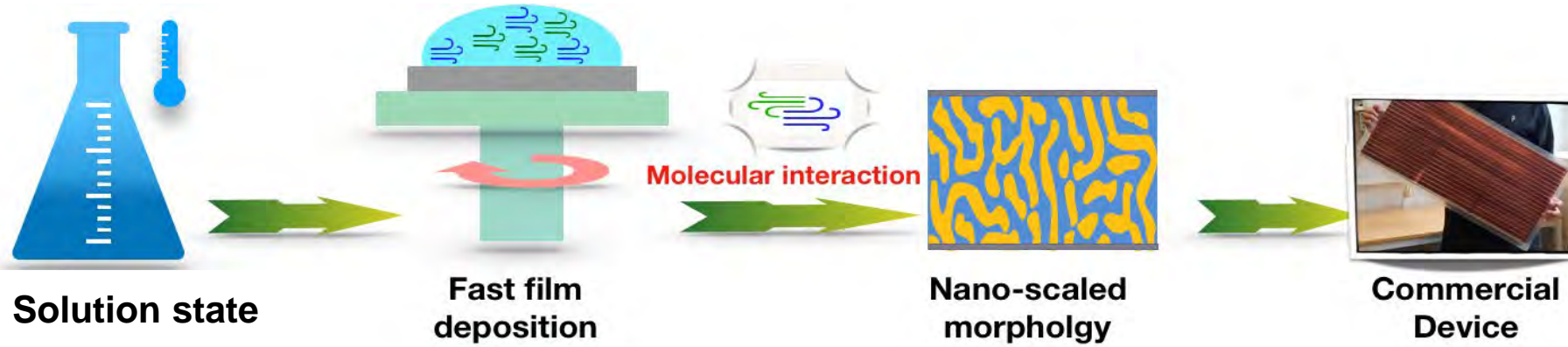
Dr. Jonas Bergqvist
Epishine AB, Sweden
Major: lamination technique,
blade-coating



Dr. Sebastian Meier
ASCA, GmbH
Major: roll-to-roll printing, device
stability

« Exchange of Experiences » - Webinar

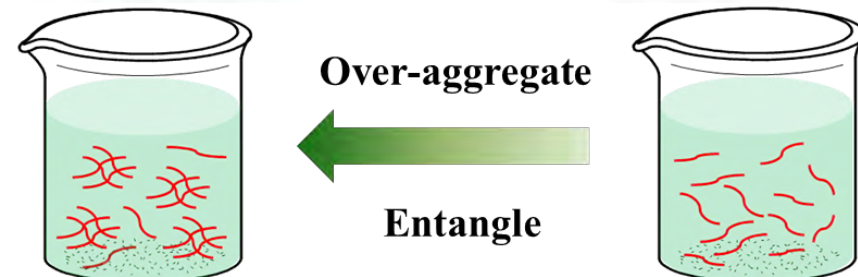
Insights, outcomes and results – 28 September 2023



Green solvents

Toxic solvents

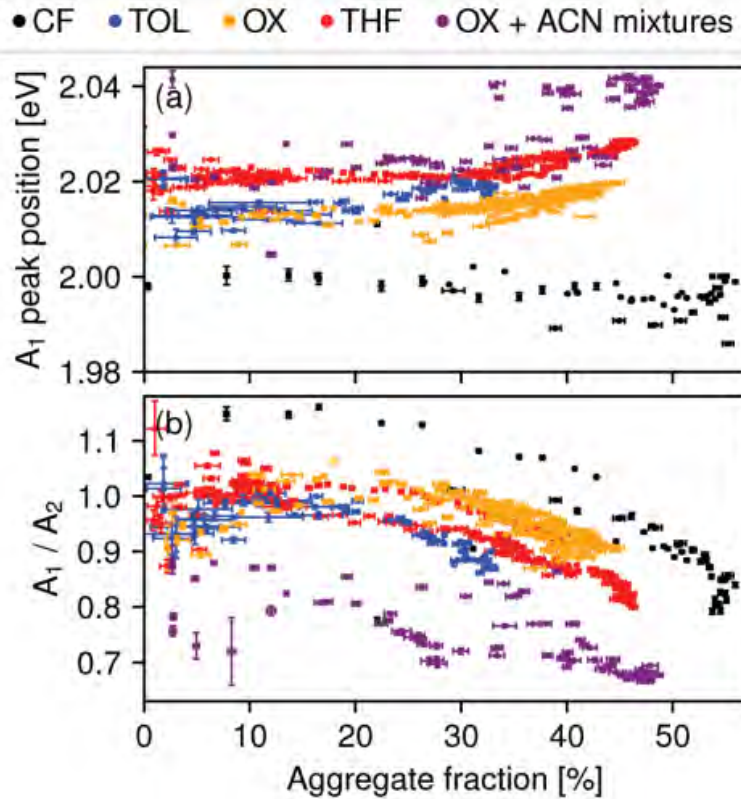
Component-solvent interaction χ_{s-p}



solvents	Boiling point/°C
Chloroform	61.2
1,2-Dichlorobenzene	180.5
chlorobenzene	132
Xylene (o-, m-, p-)	138.5-144.4
toluene	110.6

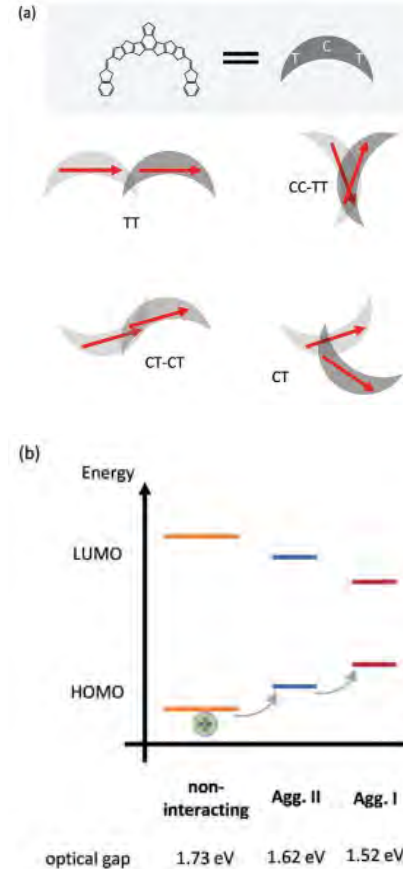
« Exchange of Experiences » - Webinar

Insights, outcomes and results – 28 September 2023



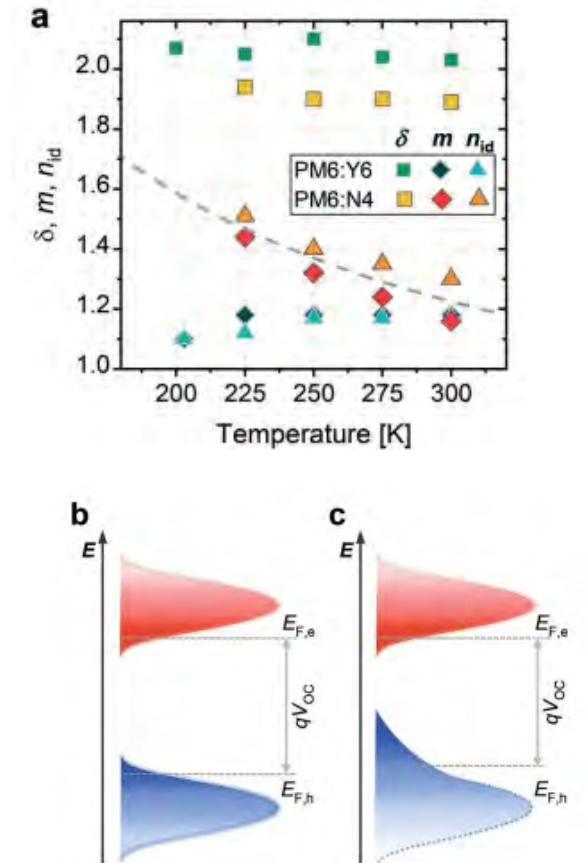
Molecular aggregation linked with various solvents

Small, **2023**, 19, 2207537



Identify the signatures of intermolecular interactions in blends

Adv. Funct. Mater. **2022**, 32, 2205711



Disorder dominates the voltage losses in the devices

Adv. Energy Mater. **2022**, 12, 2103422

(a)

List of non-peer reviewed publications (reports, briefs, books, articles targeting policy-makers, industry or other end users)

Type	Author(s)	Year / publication	Title
Press release	ASCA	2020	Record: 26% efficiency in a low-light environment for the solar technology of ARMOR solar power films
Press release	ASCA	2021	ASCA increases performance of organic solar cells by integrating new semiconductors
Press release	Epishine	2023	Epishine increases performance of printed organic solar cells by integrating new materials

0 20 40 60 80 100 120 140
Time (h)

0 1 2 3 4 5
Time (h)

0 5 10 15 20 25 30
Storage time (days)

0 5 10 15 20 25 30
Light soaking time (h)

Halogen-free processed OPVs with robust stability

J. Mater. Chem. A, **2023**, 11, 2419–2430

Crystallization driven boost in fill factor and stability in OPVs

J. Mater. Chem. A, **2021**, 9, 23783–23792

Experiences:

- Integrate resources from the collaboration team
- Complementary advantages
- Transfer mind from academia/industry to industry/academic

Critical factors and lessons learned for future successful transnational R&I projects:

- Communicate and update from each other in time
- Insufficient feedback from each workpackage
- Language differences

Thank you for your attention

