

## NFA4R2ROPV

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

*Project duration: from 09.2019 to 02.2023*

*Report submitted: 03.2022*

#### Publishable Summary

Organic photovoltaics (OPVs) are based on semiconducting carbon-based materials. In OPV industry they are fabricated out of benign (green) solvents using roll-to-roll (R2R) coating or printing techniques. Their working principle differs quite significantly from standard photovoltaics (PV), as light rays are absorbed in the bulk of organic layers not at a discrete interface. This leads to strongly different key performance indicators such as a good low and diffuse light performance, angular independence and an efficiency that rises with higher temperatures.

State-of-the-art commercially available large-scale OPV is based on fullerene acceptors with a decent efficiency up to 5%. In recent years, OPVs based on novel non-fullerene acceptors (NFA) have gained attention, as efficiencies close to 15% could be demonstrated in the lab. However, this was achieved on the basis of using toxic or harmful chlorinated solvents. It is now of large interest to the OPV industry to exploit the potential of NFAs also in large-scale OPV manufacturing, which will help to take a further step forward in the commercialization of the technology. But in this respect, strictly benign solvents need to be deployed.

This project brings together five world-leading partners (three from academia and two from industry) from the OPV community with the objective to demonstrate printed, large-scale, NFA-based OPV modules fabricated out of benign solvents with efficiencies well beyond the current state of the art. The consortium has the complementary expertise necessary for this project, including device design, morphology characterizations, photophysics, device physics, and large-scale printing. The availability of this broad range of expertise will allow us to achieve our objectives using both the fundamental mechanistic understanding and careful engineering of the fabrication processes. The results will significantly advance the state of the art of OPVs and contribute to provide affordable and clean energy. Environmentally friendly solvents for processing OPVs will also help to improve the working environment and minimize negative environmental impact of the OPV production.

#### Project consortium

Coordinator and all contact details:

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Participating countries and financing:

Country	Number of organisations involved	Project costs in EUR	Public funding in EUR
Sweden	2	620 186	412 116
Germany	2	657 456	420 633
The Netherlands	1	625 000	410 586
<i>Total</i>	5	1 902 642	1 243 335

### Funding agencies involved and contracts

Funding Agency	Contract N° and Title
Energimyndigheten	Contract no 48382-1 Title: Industriell rulle-till-rulle tryckning av högeffektiva ickefullerenacceptorbaserade organiska solcellsmoduler.
BMWi	03EE1023B, NFA4R2ROPV – Industrielle Rolle-zu-Rolle-Fertigung organischer Photovoltaik auf Basis von Nicht-Fullerene-Akzeptoren 03EE1023A, Verbundvorhaben: NFA4R2ROPV – Industrielle Rolle-zu-Rolle-Fertigung organischer Photovoltaik auf Basis von Nicht-Fullerene-Akzeptoren; Teilvorhaben: Herstellung effizienter NFA-basierter OPV-Module und Demonstratoren mittels Rolle-zu-Rolle-Druck
RVO	Contract no SOL18005 Title: Industrial roll-to-roll (R2R) printing of highly efficient non-fullerene acceptor (NFA)-based organic photovoltaics (OPV) (NFA4R2ROPV)