An experimentally-validated multi-scale materials, process and device modelling & design platform enabling non-expert access to open innovation in the Organic and Large Area Electronics Industry (MUSICODE)

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Lab and large scale OLAE devices with doped organic semiconductors by printing

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Glossary

OLAE	Organice Large Area Electronics
OIMMP	Open Innovation Materials Modelling Platform
OPV	Organic Photovoltaic
OE	Organic Electronics
HOD	Hole Only Device
EOD	Electron Only Device
SCCD	Single Charge Carrier Device
HTL	Hole Transport Layer
D	Donor
PAL	Photoactive
A	Acceptor
SE	Spectroscopic Ellipsometry
AMF	Atomic Force Microscopy
RS	Raman Spectroscopy
RMS	Root Mean Square
PL	Photoluminescence Spectroscopy
IPL	Imaging Photoluminescence
RT	Room Temperature

Contents

Publishable summary

This document reports the work carried out in Task 6.1 “Effects of dopants in OLAE nanomaterials properties and device performance (M13-40)” under the WP6 “User cases (M13-M48)” and is related to the 1st User Case. WP6 targets to the implementation of the Open Innovation Materials Modelling Platform (OIMMP) to optimize the fabrication of OLAE nanomaterials and devices by state-of-the-art manufacturing processes. The advantage of utilizing modelling will be demonstrated by the acceleration it contributes to the innovation cycle, which can be measured in terms of reductions achieved in material waste for the development of new nanomaterials and products and the performance enhancements achieved. Task 6.1.1 focuses on the experimental tests and characterization of the fabricated devices, incorporating new record-breaking materials doped with novel doping materials in order to demonstrate further efficiency improvement. These results will be used for the validation of the developed workflows and ontologies.

This report shows the experimental work undertaken during M13 to M26. Doped single carrier devices and small Organic Photovoltaic Devices (OPVs) with photoactive areas below 1 cm^2 were fabricated by different partners, using the spin-coating technique in conjunction with vacuum deposition, whereas others were fully solution processed. The single carrier devices were used to measure the charge carrier mobilities of doped donor materials (Hole Only Devices, HODs). Also, small OPV devices were fabricated using doped binary blends, in order to assess the effect of the dopants on the OPV devices performance. The fabrication process optimization was carried out, to overcome the difficulties that arose during the first fabrication attempts, while all layers were extensively characterized through several techniques, leading to valuable data on the materials’ optical and structural properties, as well as their correlation with the fabrication process parameters.