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 OPV devices with ternary photoactive nanolayers

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Publishable summary

This document reports the work carried out in Task 6.2 “Ternary donor/acceptor molecular systems for OPVs (M13-M42) under the WP6 “User cases (M13-M48)” and is related to the 2nd 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 6.2.1 focuses on the fabrication, experimental tests and characterization of single carrier and flexible printed OPV devices incorporating ternary photoactive combinations of donor and acceptor materials at different relative concentrations. These results will be used for the validation of the developed workflows and ontologies.

This report shows the experimental work undertaken during M13 and M33. Single carrier devices (Hole Only Devices, HODs and Electron Only Devices, EOD), as well as small Organic Photovoltaic Devices (OPVs) incorporating ternary combinations of materials for the Photoactive Layer (PAL), were fabricated 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 the ternary blend materials. Also, OPV devices with photoactive areas below 1 cm2 were fabricated using ternary combinations of PAL materials, in order to assess the effect of the blend ration on the OPV devices performance. All layers were extensively characterized through several technics, leading to valuable data on the materials’ optical and structural properties, whereas the final OPV devices were electrically characterized for assessment of their performance.