Interfacial layers and semi-transparent electrodes for large area flexible organic photovoltacis

Organic photovoltaics (OPVs) are considered as the potential sustainable energy source for the future. However, on the way to their commercialization performance improvements still have to be obtained, especially for large-scale devices, which significantly lack behind their inorganic counterpart. This study addresses these issues, and the results are presented in two sections. The first section focuses on the enhancement of OPV performance by incorporation of interfacial layers in form of exciton blocking and electron transport layers, which reduce the exciton recombination and charge carrier losses in the devices. Work on novel exciton blocking layer of an intrinsic organic material, 'N,N'-di-1-naphthalenyl-N,N'-diphenyl [1,1':4',1'':4'',1'''-quaterphenyl]-4,4'''-diamine (4P-NPD)', in organic small molecule-based OPVs is presented as one possible route. Using this interlayer, the efficiency of OPV devices increased by approx. 24 % compared to reference devices.

The second section deals with upscaling of highly conductive semi-transparent electrodes for rigid, as well as flexible substrates that minimize resistive losses in the large area OPVs. Here, development of highly conductive semi-transparent electrodes based on current collecting silver grids in indium tin oxide (ITO) layers on glass and flexible substrates is demonstrated, which successfully diminish the performance losses in large area OPVs due to the reduced resistance of semi-transparent electrodes.