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Energy-level alignment at hybrid interfaces between ZnO and organic semiconductors

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Designing hybrid inorganic-organic semiconductor devices requires control over the energy-level alignment at the hybrid interface to achieve desired functionality such as efficient charge-carrier transfer. In this study, the energy-level alignment of the interface between Zn-terminated ZnO (0001) and the hole transport material N,N'-bis(1-naphthyl)-N,N'-diphenyl-1,1'-biphenyl-4,4'-diamine (alpha-NPD) p-doped with the strong electron acceptor 2,2'-(perfluoronaphthalene-2,6-diylidene)dimalononitrile (F6TCNNQ) is investigated. It is shown that F6TCNNQ can be used to control the energy-level alignment of both, the inorganic and the organic semiconductor. Using photoelectron and optical absorption spectroscopy, it is identified that F6TCNNQ on the ex situ annealed ZnO induces surface band bending and increases the work function by up to 1.6 eV and that F6TCNNQ undergoes integer charge transfer with alpha-NPD.

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