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Sommario

The aim of the research activity focused on the investigation of the correlation between the degree of purity in terms of chemical dopants in organic small molecule semiconductors and their electrical and optoelectronic performances once introduced as active material in devices. The first step of the work was addressed to the study of the electrical performances variation of two commercial organic semiconductors after being processed by means of thermal sublimation process. In particular, the p-type 2,2???-Dihexyl-2,2?:5?,2??:5??,2???-quaterthiophene (DH4T) semiconductor and the n-type 2,2???- Perfluoro-Dihexyl-2,2?:5?,2??:5??,2???-quaterthiophene (DFH4T) semiconductor underwent several sublimation cycles, with consequent improvement of the electrical performances in terms of charge mobility and threshold voltage, highlighting the benefits brought by this treatment to the electric properties of the discussed semiconductors in OFET devices by the removal of residual impurities. The second step consisted in the provision of a metal-free synthesis of DH4T, which was successfully prepared without organometallic reagents or catalysts in collaboration with Dr. Manuela Melucci from ISOF-CNR Institute in Bologna. Indeed the experimental work demonstrated that those compounds are

	responsible for the electrical degradation by intentionally doping the semiconductor obtained by metal-free method by Tetrakis (triphenylphosphine)palladium(0) (Pd(PPh3)4) and Tributyltin chloride (Bu3SnCl), as well as with an organic impurity, like 5-hexyl-2,2':5',2''-terthiophene (HexT3) at, in different concentrations (1, 5 and 10% w/w). After completing the entire evaluation process loop, from fabricating OFET devices by vacuum sublimation with implemented intentionally-doped batches to the final electrical characterization in inherent-atmosphere conditions, commercial DH4T, metal-free DH4T and the intentionally-doped DH4T were systematically compared. Indeed, the fabrication of OFET based on doped DH4T clearly pointed out that the vacuum sublimation is still an inherent and efficient purification method for crude semiconductors, but also a reliable way to fabricate high performing devices.
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