Printed organic photodetectors

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Printed organic photodetectors (OPDs) can transform plastic, paper or glass into smart surfaces. This innovative technology is now growing exponentially due to the strong demand in human-machine interfaces [1, 2]. To date, only niche markets are targeted since organic sensors. But as their performances start to compete their inorganic counterparts, their use will spread over the market.

Our work establishes the rules to achieve a *state-of-the-art* organic photodetector by printing techniques [3]. We demonstrate that it is possible to engineer a highly efficient organic sensor approaching the performances of Si-based photodiodes in terms of dark current, responsivity and detectivity by using low-cost printing technology. As a result, we simplified the device architecture as much as possible to make the whole process compatible with large-area printed technologies and industrial constraints. In a second part, we also report long operational lifetimes of organic photodetectors (OPDs) and the failure mechanisms investigation [4]. The combination of the thermally stimulated current (TSC) and the I-V characteristics versus temperature (I-V-T) techniques along with the extensive use of the drift-diffusion simulations all reveal that the observed degradation is the consequence of the generation of shallow traps (0.2 eV, $N_T = 10^{16}$ cm^{-3}) that significantly reduce the charge carrier mobility. In contrast, deep traps (0.7 eV, $N_T = 7 \times 10^{15}$ cm^{-3}) are found to be present on freshly prepared samples and their concentration remains unchanged after ageing.

References

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