Extended Abstract of PSA-19 (review)

O-11

Development of High Performance Printed Organic Transistors by Controlling Charge Carrier Density

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I would like to talk our recent progress in the field of printed organic and perovskite field-effect transistors. I will mainly address how to improve field effect mobility and other parameters by optimizing semiconductor films and contact and controlling charge carrier density of active layer.

1. Summary of talk

Organic field-effect transistor (OFETs), the central building blocks of organic electronics, still suffer from low performance and difficulty in manufacturing circuits. This is due in part to the absence of doping, which has mostly been excluded from OFET applications for the serious concern about uncontrollable dopant diffusion. Doping enabled modern semiconductor industry to build the essential components like ohmic contacts and P-N junctions empowering the composed devices to function as designed.[1] Recent breakthroughs in organic semiconductors and organic doping techniques demonstrated that doping can be a key enabler for high-performance OFETs too [2-3]. However, the present knowledge of organic doping mechanism, in particular the special doping roles, the doping principles and potentials for OFETs, is very limited. Therefore, in this view, we address OFET doping from a device perspective. The talk provides a brief review of doping basics, followed by an overview of the doping roles in advanced organic field-effect transistors. These fundamentals help us better understand why and how doping is used in a transistor for the projected characteristics, which then inspires more thinking on the potentials for OFETs. In addition, we introduce printable p-type metal halide and perovskite semiconductors which have been developed in our group recently for FET applications.[4,5]

2. References

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