Materials science tools for the new frontiers of organic electronics

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The employment of organic semiconductors (OSCs) promises to widen the realm of electronics to countless new applications, thanks to the advantageous properties of organics.

Here I will discuss how a fine microstructural tuning of OSCs can lead to Organic Field-Effect Transistors (OFETs) exhibiting charge carrier mobilities exceeding 1 cm^2/Vs.[1,2] Moreover, I will show how different strategies can be adopted to control the device operation. For instance, doping of OSCs through molecular additives offers great opportunities to adjust the device properties[3] in OFETs,[4,5] Organic Solar Cells (OSCs)[6], Organic Photodetectors (OPDs),[7] Organic Diodes.[8] Blending of insulating and semiconducting polymers or molecular and polymeric semiconductors is on the other hand another convenient method to tune the transport properties of OSC.[4,9,10] Moreover, the introduction of novel architectures[8] and materials[11,12] can widen the reservoir of systems from which tapping in towards the development of increasingly diverse and efficient applications.

Further, I will show how the knowledge acquired during the investigation of conventional organic electronics can be applied to the rising field of edible electronics, which aims to develop a technology that is capable to monitor real-time the gastro-intestinal tract. Here, I will show how transistors, the fundamental building block of any circuit, can be reliably fabricated employing edible materials, enabling the achievement of fully edible devices.

Finally, I will show how the employment of novel natural-based semiconductors, similar to those used in edible applications, can unlock a new generation of truly environmentally friendly, circular electronic devices. To do so, I will show how it is needed to re-think the design of organic electronic devices, by combining these natural-based materials with green processing routes and a thorough eco-design of the entire device fabrication.

Bio

Alberto Scaccabarozzi is a Postdoctoral Fellow at the Center for Nanoscience and Technology (CNST) of the Istituto Italiano di Tecnologia in Milan (Italy). He received his PhD from Imperial College London (UK) in 2017 under the supervision of Prof. Natalie Stingelin, followed by postdoctoral appointments at CNST in M. Caironi's group and at King Abdullah University of Science and Technology (KAUST, Saudi Arabia) in Prof. T. D. Anthopoulos' group. His research interests encompass the broad field of organic electronics, in particular the study of structure-processing-property relationships of organic semiconductors for a wide range of devices, especially Organic Field-Effect Transistors (OFETs).

References:

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