

Title: "When Organic Semiconductors Merge with 2D Hybrid Perovskites"

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Abstract: For many years, organic semiconductors dominated the field of thin film electronics, and this as well as polymer or as defined molecular materials. Since 2009, the focus shifted towards a rediscovered group of materials also processible as thin films from solvents, e. g. hybrid organic inorganic lead halide perovskites (HOIPs). At this moment and certainly in the field of solar cells, the 3D HOIPs are dominating the research activities reaching a PCE of 27%, surpassing single crystal silicon solar cells. However, lifetime under illumination is still a major problem. The use of mixed 3D/2D HOIPs shows dramatic improvements in stability. 2D HOIPs in their own right, on the other hand are potentially also materials with interesting properties to be incorporated in opto-electronic devices. In our group, since about 8 years, research is focussed on the study of 2D HOIPs in which larger organic molecules are incorporated with potential semiconductive properties. Our goal is to disclose and explore a potential synergy between organic semiconductors and the inorganic layers present in 2D HOIPs. The research aims to disclose structure-property relationships that lead to stable 2D HOIPs with specific opto-electronic properties, more specific to study energy and charge transfer processes between the inorganic layers and the organic semiconductive ligands. Structural insights will be presented and examples of integration of 2D HOIP interlayers in 3D HOIP solar cells leading to passivation of defects and increases in PCE and stability.

Short CV: Dirk Vanderzande defended his PhD in organic synthesis under the guidance of prof. Georges Hoornaert (KULeuven) in 1986. From 1986 till 1987 he held a post-doc position in the group of prof. Luc Vanquickenborne (KULeuven) on the theoretical modelling of Diels-Alder and retro-Diels-Alder reactions. Also in 1987 he joined the UHasselt as senior researcher which resulted to a tenure track position in 1992, starting research activities in the field of the synthesis and characterisation of organic semiconductive polymers for use in LEDs, transistors and thin film organic solar cells. In 2016 a new research line was started on the self-assembly and characterisation of 2D hybrid organic inorganic lead halide perovskites. From 2010 on, he held also the position of director of the research institute imo-imomec, a joint research institute of UHasselt and imec on materials for advanced applications. Since October 2022 he retired as emeritus professor of the UHasselt. The scientific activities resulted in more 380 papers, 12000 citations and an h-index of 55, and he is also author of 25 patent applications. The group has also participated in many projects within the different framework programs of the EU.