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High-Mobility Band-Like Charge Transport in 2D Covalent- and Metal- Organic Frameworks

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Organic based 2D layered materials (2DLMs) including 2D covalent and metal organic frameworks (COFs and MOFs) are promising candidates for traditional applications in gas storage and separation as well as catalysis. This is due to the long-range crystalline order that can be achieved in them as well as their tunable porosity and chemistry. Synthetic chemistry efforts aiming an enhanced coupling between their building block constituents have recently led to the design of (semi-)conducting MOFs and COFs displaying high conductivities and record charge carrier mobilities. These achievements have opened the path for their application in opto-electronics. Yet, despite being a critical aspect for the development of 2DLM based electronics, understanding the true nature of charge transport in these novel materials by stabilising reliable structure-property-function relations is largely unexplored. Here I will present time-resolved high-frequency (terahertz) conductivity studies of state-of-the-art organic based 2DLMs materials revealing semiconducting behavior and record charge carrier mobilities. The demonstration of band-like charge transport and record-high mobilities in semiconducting 2D COFs and MOFs reveal the potential of (porous) electrically conductive 2DLMs to be employed as active materials in opto-electronics devices.

References:

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