

Controlling the Self-Assembly and Polymerization of Organic Molecules on Alkali Halide Surfaces

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Achieving control over the formation of molecular one dimensional (1D) and 2D structures on insulating substrates is important for designing novel functional materials and devices. In order to achieve this goal, we decided to combine, (i) atomically clean ionic substrate with different lattice constants, (ii) on-demand synthesized molecules with various functional groups, and (iii) well adapted growth conditions. In such a way we were able to control the self-assembly of large domains of defect-free organic layers [1], to understand the role of molecular flexibility and entropy in the nucleation and growth of these layers [2], and to initiate a novel, UV-light induced chain-polymerization of 1D fibres on a pure insulator [3, Fig. 1].

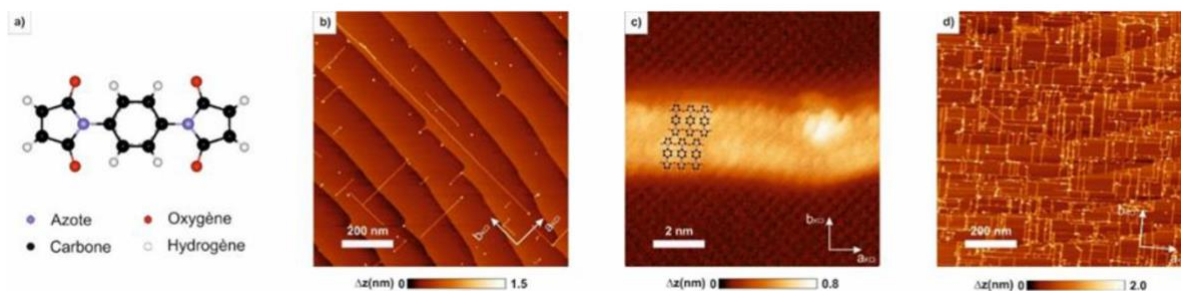


Fig. 1: Radical chain polymerization of dimaleimide molecules (a) on a KCl surface. ncAFM topography images showing (b) spontaneously polymerized fibres with up to 1 μ m in length, (c) the inner zig-zag structure of a polymer fibre and its orientation with respect to the KCl crystal axis, and (d) the increased number of fibres formed when the polymerization was assisted by UV-light illumination.

The key issue in all of these experiments is to balance the molecule-molecule and molecule-substrate interactions in such a way that the desired interactions govern the growth mode and that the (pre-) designed structures can be formed.

References

- [1] A. Amrous *et al.*, *Adv. Mater. Interfaces* **1**, 1400414 (2014).
 [2] J. Gaberle *et al.*, *J. Phys. Chem. C* **121**, 4393 (2017).
 [3] F. Para *et al.*, *Nature Chemistry* **10**, 1112 (2018).