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On-Surface Synthesis of 1D And 2D Conductive-MOF

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On-surface synthesis under ultra-high vacuum allows to control matter at the atomic level, with important implications for the design of new 1D/2D materials with remarkable electronic, magnetic or catalytic properties [1]. Our objective is to synthesize covalent single layer of 1D coordination polymers by on-surface polymerization reactions. These polymers are very stable thanks to the robustness of the covalent bonds involved and offer the advantage to preserve the functionality of the molecule in the self-assembly. Through this approach, we obtained different 2D polymers but due to the non-reversible character of the covalent bond, self-healing is prevented leading to the formation of polymers with limited size (few tens of nanometers). We show that extended materials can be obtained from a controlled co-deposition process of suitably set of parameters, as it is the case by co-deposition of Tetrahydroxyquinone and Copper on Ag(111) (Figure 1a). Linear molecular precursor can also be co-deposited with metal atoms to form nanoribbon or 1D conductive MOF at surfaces. The co-deposition of quinonoid zwitterion molecules with iron atoms on a Ag(111) surface allowed to achieve unprecedented micrometer sizes conjugated nanowires (Figure 1b). This work opens up the field of on-surface chemistry for the construction of large covalent metal organic coordination networks materials in a single layer regime [2-3].

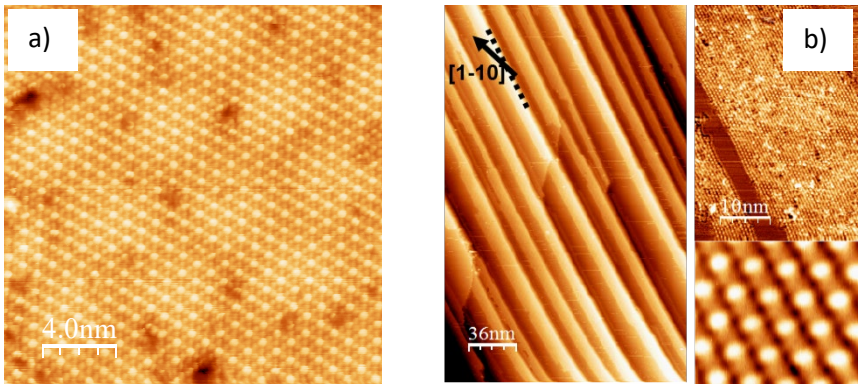


Figure 1: Co-depostion on Ag(111) of (a) Tetrahydroxyquinone and Copper (b) quinonoid zwitterion molecule and Iron

References:

[1] Liu, J.; Abel, M.; Lin, N., J. Phys. Chem. Lett. 022, 131356-1365 (2022)

[2] Shaiek, N.; Denawi, H.; Koudia, M.; Hayn, R.; Schafer, S.; Berbezier, I.; Lamine, C.; Siri, O.; Akremi, A.; Abel, M.. Adv Mater Interfaces 9 (23) (2022);

[3] Denawi A. H., Hayn R., Vach H., Rochefort A., Koudia M., Abel M. Surfaces and interfaces accepted (2026)