Reticular Chemistry at Interfaces as a form of Nanotechnology

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The groundbreaking work that led to the emergence of metal-organic frameworks (MOFs) represents a major milestone in the design of materials with controlled atomic or molecular architectures.[1]
MOFs are organic-inorganic crystalline materials; they have attracted particular attention owing to their tremendously high surface area and tunable pore size, properties that make them ideal candidates for applications including gas storage, separation, and catalysis.[2]

Notwithstanding tremendous research efforts, the development of MOFs is held back by the difficulty of producing large MOF solids. The small crystal size markedly limits the applicability of MOF-based materials in, e.g., gas purification or filtration.

Driven by a renewed interest in 2D materials, scientists have also developed two-dimensional MOFs using interface-assisted methods.[3] The synthetic strategies developed, however, do not take advantage of the large amount of knowledge available for the synthesis of MOF. Indeed, MOF synthetic procedures typically rely on in situ SBU synthesis, which makes the process challenging to be transferred to an interface-assisted method.

RESTRAIN aims at tackling the main limitations of 2D and 3D MOFs related to in situ SBU production. We shall develop a novel approach of reticular chemistry for the design of 2D MOFs and their application as templates for large MOF crystals. RESTRAIN stems from recent findings achieved by the Shahgaldian group on the design of 2D MOFs,[4] and shall take advantage of new SBU design strategies that will be developed by the De Roo group (UniBas). Our approach shall let us leap ahead of current technology by using well defined and characterized SBUs in combination with designer organic amphiphiles.

[1] Yuan, S.; *et al.*, *Adv. Mater.* **2018**, *30*, e1704303.
[2] Yuan, S.; *et al.*, *Adv. Mater.* **2018**, *30*, e1704303.
[3] Dong, R.; Zhang, T.; Feng, X., *Chem. Rev.* **2018**, *118*, 6189-6235
[4] Moradi, M.; *et al.*, *Sci. Adv.* **2019**, 5, eaav4489