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Metal-organic framework nanocarriers – A new groundbreaking “magic bullet”?

(see the abstract in the appendix)

Host: Thomas Burg

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Since the emergence of nanotechnology, it is a matter of fact that the synthesis and the manipulation of nano-objects can drastically change or even create new functionalities from the nano- to the macro-world and from inorganic matter to living cells.

Within the context of material sciences, researchers have shown that the combination of inorganic and organic chemistries in one single material, named metal-organic framework (MOF), offers structural designability at the molecular level together with tunable porosity and chemical functionalisability. In light of this, the main idea is to design hybrid nanomaterials based on metal-organic frameworks (MOFs), which could offer a new platform for biomedical applications. MOF nanoparticles (MOF NPs) combine the richness of bulk MOF chemistry with the surface- and size- dependent properties of the nanoworld. Bringing together these two worlds leads to an interdisciplinary field of research between chemistry, physics, materials science, and engineering. The past and still ongoing intensive development of synthesis routes of innovative functional MOF materials is currently enriched through their extension to the nanolevel. In doing so, scaling-down the MOF size could allow to tackle medical applications as diagnosis and therapy, which require nanometric dimensions to overcome several biological barriers. This is especially the case for drug delivery systems, which should be able to selectively and specifically deliver a drug to a site of interest.

In this talk, we describe our research aiming at the establishment of material chemistry guidelines to engineer smart MOF nanoparticles (MOF NPs) able to unlock their potential for applications in the field of life sciences. To successfully achieve smart nanoMOFs, we aim to bring together five fields of expertise as illustrated up in the Figure. In particular, we seek to answer the following question: "*Are MOF NPs eligible as the next generation of drug nanocarriers?"* and to highlight the specific properties of MOF NPs that make them unique.[1-3]

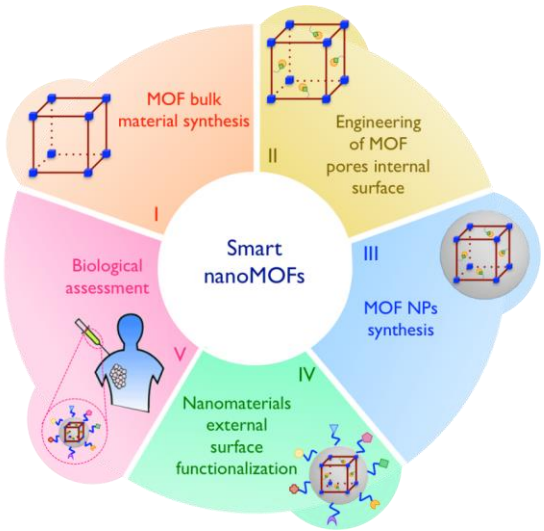

Figure | Thematic focuses of our research.

References

[1] S. Wuttke, M. Lismont, A. Escudero, B. Rungtaweevoranit, W. J. Parak, Biomaterials 2017, 123, 172-183.

[2] M. Lismont, L. Dreesen, S. Wuttke, Adv. Funct. Mater. 2017, 27, 1606314.

[3] R. Freund, U. Lächelt, T. Gruber, B. Rühle, S. Wuttke, ACS Nano 2018, 12, 2094-2105.