Combining mechanochemistry and structural analysis for the design of nanocrystalline reticular materials

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In the past years, mechanochemistry has been proved to be an environmentally friendly strategy for the preparation of organic and metal−organic materials, spanning from molecular crystals to framework structures. Typically, this synthetic method reduces the use of solvents, while minimising energy consumption and chemical waste.[1,2] However, the structural characterization of new materials obtained by manual or ball milling can be challenging due to their small crystallite size and possible twinning induced by the grinding process, as well as to the presence of multiple phases. These problems can be tackled by combining conventional single-crystal and powder X-ray diffraction techniques with electron diffraction, which enables the analysis of single nanocrystals also when mixed phases are present in the sample.[3,4]

This talk will first focus on proofs of concept relative to the combined use of mechanochemistry and structural analysis to design nanocrystalline, reticular materials [4,5]. Subsequently, some specific examples of frameworks for different applications will be discussed. In particular, we have directed our attention to the synthesis of flexible MOFs, capable of interacting with fluorinated analytes, and of triphenylene-based MOFs to be used as electrodes for the development of new supercapacitors.

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