DIPARTIMENTO DI SCIENZE CHIMICHE

UNIVERSITÀ DEGLI STUDI DI PADOVA

Mechanochemistry and Biomass Valorization: Opportunities in Advanced Materials Synthesis for Catalysis

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Advancing a sustainable, circular future hinges on renewable feedstocks, recyclable catalysts, and waste reduction—key priorities in global agendas.

Notably, developing biomass-based industries offers a promising route to reduce fossil dependence, with biowaste valorization emerging as a vital strategy for achieving climate neutrality.

To further minimize environmental impact, reducing solvent consumption, ideally through complete elimination or significant reduction, is also a critical goal. In this context, traditional batch mechanochemistry via ball milling has proven highly effective for the solvent-free synthesis of diverse materials, including supported metal and metal oxide nanoparticles, perovskites, nanocomposites, metal-organic frameworks (MOFs), and bioconjugates.

More recently, mechanochemical technologies have evolved to support continuous-flow synthesis, especially through mechanochemical twin-screw extrusion (MtE). This technique offers enhanced control over reaction conditions, greater scalability, and industrial compatibility, yet remains underexplored in the field of materials synthesis.

This seminar will highlight the **integration of biomass-derived wastes and mechanochemical approaches** for the development of advanced catalytic architectures. Emphasis will be placed on the preparation of **bioconjugated hybrid materials**, biomass-templated metal oxide nanoparticles, *N*-doped carbons, and supported metal nanoparticles, showcasing their potential across **catalysis and sustainable materials science**.

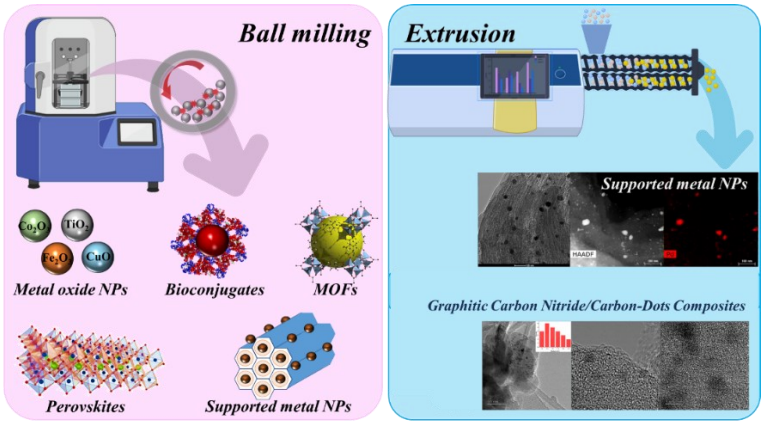

Figure 1. Schematic representation of batch and continuous flow mechanochemical approaches for materials synthesis.

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