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. 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**,[1] biomass-templated metal oxide nanoparticles, ***N*-doped carbons**, and supported metal nanoparticles,[2] showcasing their potential across **catalysis and materials science**.

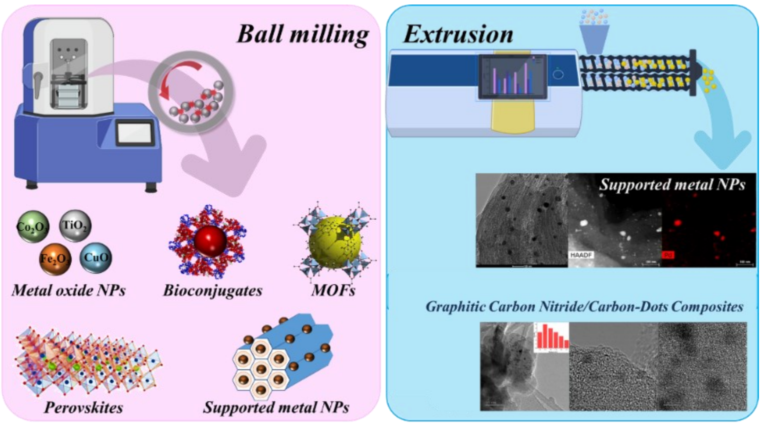

Figure 1. Schematic representation of batch and continuous flow mechanochemical approaches for materials synthesis.

References

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