Invited Lecture

Balancing the Mechanochemical Force for Crystal Polymorph Control

Adam Michalchuk

University of Birmingham

a.a.l.michalchuk@bham.ac.uk

Mechanochemical methods offer a greener alternative to chemical and materials processing. However, these methods are also seen as being 'brute force' methods with little opportunity to fine-tune the outcome. This view has caused many to overlook the potential of mechanochemical technologies with concern over reproducibility, reaction design, and reaction control. This view is the consequence of the limited understanding of how mechanochemical reactions occur, demanding dedicated studies into the mechanisms that underpin mechanochemical transformations [1].

In this contribution we will discuss recent advances in understanding how mechanochemical transformations occur. In particular, we will show how this understanding can be used to fine-tune reaction profiles of mechanochemical transformations.[2] We will discuss how the emerging undrestanding of mechanochemical mechanisms allows us to control solid state polymorphism, including through innovations in thermo-mechanical strategies [3]. Throughout the talk we will discuss recent advances in studying mechanochemical mechanisms and polymorphism using time-resolved in situ monitoring techniques,[4] highlighting the mechanistic details that can be resolved using these emerging techniques [5].

[1] Michalchuk et al (2021) Front. Chem. 9, 685789.

[2] Linberg et al (2023) Chem. Eur. J. e202302150.

[3] Linberg et al (2023) Faraday Discuss. 241, 178-193.

[4] Michalchuk and Emmerling (2022), 61, e202117270.

[5] Lampronti et al (2021) Nature Commun. 12:6134.