Pushing the Limits: Evolving Twin-Screw Extrusion for Next-Gen Mechanochemical Processing

Andreas F. Giglio, Cameron D. Webster and Deborah E. Crawford*

Our previous work has established twin-screw extrusion (TSE) as an effective approach for scaling mechanochemical reactions into continuous, large-scale, solvent-free processes. Such has been the impact of this technology that it has seen commercial adoption for the synthesis of metal-organic frameworks,[1] with our work cited by IUPAC as one of the top ten emerging technologies set to transform the world.[2] Having expanded our research to encompass a diverse range of materials, including fine organic chemicals[3] and multi-layered graphene,[4] we are now focused on further improving the versatility of twin-screw extrusion. To this end, we are adapting the twin-screw extruder through the integration of complementary technologies, thereby enabling access to advanced chemical manufacturing and the synthesis of exotic compounds typically beyond the reach of conventional TSE methods.

References:

1) Crawford *et al*. *Chem. Sci.*, 2015, **6**, 1645.
2) Gomollón-Bel, *Chem. Int.*, 2019, **41**, 12.
3) Crawford *et al*. *Green Chem.*, 2017,**19**, 1507.
4) Chen et al. *Adv. Mater. Technol.,* 2024, **9**, 2301780.

Biography:

Deborah Crawford is an Assistant Professor of Sustainable Materials and Manufacturing at the University of Birmingham, with a joint affiliation in the School of Chemistry and the School of Chemical Engineering. Deborah is also Associate Editor for *RSC Green Chemistry*. She earned her Ph.D. from Queen's University Belfast (QUB) in 2015, focusing on gold(I) diphosphine complexes as optical sensors. Following this, she was seconded to MOF Technologies, where she explored the continuous, solvent-free synthesis of metal-organic frameworks (MOFs) using twin-screw extrusion (TSE). She then continued at QUB to further investigate mechanochemical scale-up via TSE and contribute to the development of Type 2 Porous Liquids. Her research is focused on advancing mechanochemical synthesis, either by developing new methodologies or adapting existing technologies. Her work spans a broad range of materials, from fine chemicals to supramolecular structures, with a strong focus on sustainable and scalable manufacturing.