Transforming Foundation Industries: Challenges and Effective Resource Efficient Strategies

Ahmed M.E. Khalil
Chemical and Environmental Engineering and Materials Science University of Exeter

https://doi.org/10.5109/7157930

出版情報：Proceedings of International Exchange and Innovation Conference on Engineering & Sciences (IEICES). 9, pp.22-23, 2023-10-19. 九州大学大学院総合理工学府
バージョン：

Keynote Speaker

Name: Ahmed M.E. Khalil
Research Fellow, Dr (PhD), Chemical and Environmental Engineering and Materials Science
University of Exeter, United Kingdom of Great Britain and Northern Ireland (UK)
Email: a.a.khalil@exeter.ac.uk

Short Biography

Dr Ahmed Khalil is a well-recognised researcher in the materials science and environmental application domains. He pursued his graduate studies at Kyushu University, Japan, and got his PhD degree in Chemical and Environmental Engineering. He has been working in the field of (nano)material, ceramics, and functional materials synthesis for over 10 years and has produced over 30 peer-reviewed publications, mostly in high-impact factor journals, and received over 1,220 citations. He participated in a number of international conferences, exceeding 22 events, and won the best presenter award on several occasions. At the University of Exeter, UK, he worked on and led the independent execution of a 3-year research programme for the NERC-funded Fate and Management of Emerging Contaminants (FaME) project. Also, he has been assisting in the management of the Ceramics, Catalysis, and Functional Materials Laboratory at the University of Exeter and supervising more than 10 undergraduate and graduate students. Since the conclusion of the FaME project, he has been working on the EPSRC-funded Transforming the Foundation Industries Research and Innovation Hub (TransFIRe) Programme, in which he plays a vital role in shaping the UK industry.

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Abstract

Transforming Foundation Industries (FIs) has emerged as a critical imperative in the 21st century, driven by the serious worldwide issues and urgent global challenges of climate change and long-term sustainability. The UK Research and Innovation (UKRI)-funded TransFIRe (Transforming Foundation Industries Research and Innovation Hub) programme has taken centre stage in addressing these growing challenges. The consortium hub involves 12 institutes and over 80 companies, including 14 non-governmental organisations, and comprises three workstreams and six technical working groups, each dedicated to one of the six foundation industries: cement, ceramics, chemicals, glass, metals, and paper. Through communications with industry, academia, and communities and the proposal of new strategies, the hub seeks to drive the transformation of FIs. One significant stride towards transformation lies in conducting a context analysis of these industries, which identified key intervention points to enable transformative change that can pave the way for transformative change within the FIs with the potential to catalyse improvements. For instance, the analysis highlighted numerous transformative change drivers and barriers, emphasising the critical importance of decarbonisation and energy-saving strategies while acknowledging challenges such as foreign government policies, trade barriers, skills shortages, and costly alternative energy sources. Following the identification of challenges via context analysis, promising strategies were proposed. ThermoRecycliSt is one of the resource-efficient techniques employed in this endeavour. This Thermodynamic simulation-guided (waste) Recycling Strategy offers a reliable means to assess waste/byproduct recycling without arduous experimental experiments, saving significant time and money. ThermoRecycliSt accurately predicts phase changes/evolution of waste materials, both individually and in the final products. It is validated against experimental data from existing literature on waste recycling and case studies related to our industrial partners. Additionally, more strategies are being implemented to optimise resource flows within and between these industries and achieve industrial symbiosis. Several industrial symbiosis workshops hosted by TransFIRe gathered over 50 participants from 30+ organisations as representatives from the six foundation industries and their supply chains, fostering collaborative efforts to identify potential synergies. By addressing challenges through context analysis, embracing resource-efficient strategies like ThermoRecycliSt, and promoting industrial symbiosis, TransFIRe takes significant strides towards creating sustainable and resilient FIs in the UK and beyond and shaping a greener future for FIs.