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Editorial

Chemical Reaction Engineering: A Fundamental Approach Towards Sustainable Technology Development

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Chemical Reaction Engineering (CRE) is a specialized area of chemical engineering and technology involving chemical reactions, catalysts and reactors. In more specific way, it deals with the chemical reaction systems catalytic (homogeneous, heterogeneous, photocatalysts, etc.) or non-catalytic and convertor (fixed bed, fluidized bed, slurry bed, micro-channel, or structured reactors), where raw material contorted in to desired products. Therefore, CRE is the heart of chemical process industry. The whole process efficacy and sustainability moves around the performance of catalyst and/or reactor. Therefore, CRE is a specific engineering activity emphasizing on successful design and operation of chemical reactors and associated with the exploitation of chemical reactions on laboratory to the commercial scale. Now CRE researchers/scientists are playing significant role in developing future technologies with strong footprints of carbon efficiency, energy efficiency and sustainability by developing custom made catalysts (highly active and selective) and robust reactor designs.

The key objective of CRE is focused on the study and optimization of chemical reactions to achieve best reactor design and performance, which involved the interactions of flow phenomena, mass and heat transfer, and reaction kinetics. The reactor performance is likely to be related to feed composition and reaction operating conditions through the aforementioned factors. Conventionally, it is applied to petroleum and petrochemical areas; however, with the help of reaction chemistry and chemical engineering concepts, it could be utilized to areas such as chemicals, pharmaceuticals, waste treatment, microelectronics, nanoparticles in advanced materials, bio-chemical engineering, enzyme technology, renewable energy systems, living systems, environment/pollution prevention, sustainable development, as well as to optimize a variety of reaction systems through modeling and simulation techniques.

Today, it covers from fundamental and molecular level chemistry to a variety of large scale chemical production systems. Therefore, the recent research trend indicates a variety of sub-areas in chemical reaction engineering to be focused. This special issue aims to cover the broad range of research topics within the chemical reaction engineering. These include (but not limited) catalysis and catalytic reaction engineering; Reaction mechanism, kinetics and pathways; Catalyst activity and deactivation; Reactor design; Multiphase reactors; Reactor safety and environmental issues; Emerging reactor technologies; Novel reactions, simulations and optimization of the reaction systems; Reaction optimization through modeling; Sustainable reaction engineering systems; Reaction analysis and monitoring; Environmental chemical reaction and process engineering; Environmental separation processes; Clean process technology and waste minimization; Nanostructured, composite and hybrid materials with advanced properties and applications in chemical reaction engineering, and have been extensively studied from laboratory to industrial scale. Biochemical reaction engineering is also an interesting research area. Photocatalytic reaction system is currently a very economical and dynamic research field within chemical reaction engineering, and papers from this area are particularly encouraged.

This special issue highlights variety of different topics and new trends in catalysis and reactor engineering. It covers catalyst design and synthesis, catalyst performance and physicochemical properties, catalyst scale-up and deactivation, kinetics and reaction mechanisms, reactions and cross coupling chemistry, nano-technology, reactor design and operation, reactor modelling and performance analysis, micro-reactors and novel reactor concepts, and technology developments. Issue comprises technical notes, communications, research articles and reviews from researchers across the globe. These perspective articles will demonstrate customized catalyst design, structured catalyst and reactor, the kinetic modelling of complex reaction systems, dynamic and study state mathematical modelling of non-uniform multiphase transport phenomena, for fixed bed, fluidized bed, slurry bed, membrane reactors, for improving reactor design and performance relevant to industrial practice. Key is to integrate CRE (fundamentally rooted representation at all length and time scales) approach with overall process improvement/ optimization. The message here is that complexity can be modelled, and can be exploited by design inherently robust system for future sustainable technology developments and existing revamps.

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