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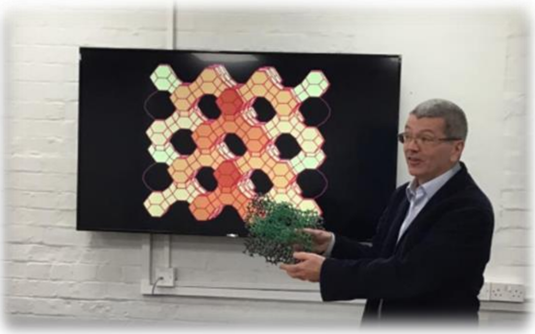

The circular economy and the upscaling of polymer waste to chemicals using refinery catalytic processes

Professor Arthur Garforth
University of Manchester

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1 South, Room 0.01

Moving from a linear economy to a circular economy will require a step change in the thinking by all stakeholders in the value chain; namely, from design to producer to retailer to consumer not forgetting the importance of legislation and importance of political motivation and funding to encourage all.

Polymers are ubiquitous because of their very nature of their properties, for example, they are extremely stable and hence decomposition occurs over extended periods, and with the introduction of more stringent environmental regulation and rising landfill costs there is an increasing need to redirect plastic waste from landfill towards recycling options, enhancing recovery of raw materials.

There are two major routes for the recycling of plastic waste; mechanical and feedstock. The most widespread approach to ***feedstock recycling*** is the *pyrolysis (or **cracking**)* of the plastic waste. However, this process requires high operating temperatures (typically 500°C – 900°C) with a subsequent large adiabatic temperature drop across the reactor (fixed bed or fluidised) which combined with catalyst deactivation results in significant processing issues. The use of polymers in an FCC-like process would potentially lead to a narrow range of components easily bolted on to a refinery operation.

Another option to catalytic cracking of plastics is that of ***hydrocracking***, which in the presence of a suitable catalyst not only offers the potential for the selective recovery of useful chemical fractions, but is also is tolerant of the presence of heteroatoms. The hydrocracking process is more energy neutral and offers the opportunity again to produce medium chain hydrocarbons such as naphtha and diesel fuel and the use of hydrogen in the reactor minimises the generation of coking and thus extends the viable lifetime of the catalyst.

Biography

Arthur obtained his PhD at Manchester in 1984 on the artificial maturation of kerogen and went on to work on zeolites on a BP research award until 1987. Arthur joined UMIST, now the University of Manchester, in 1998 after working in petrochemical and chemical industry.

In 2019 he was promoted to Professor of Catalysis in Chemical Engineering having been made a Fellow of the Royal Society of Chemistry in 2016.

He was the recipient of the Royal Society Brian Mercer Innovation award in 2008 and the Royal Academy of Engineering Exxon Mobil Excellence in teaching award in 2009. The Brian Mercer award resulted in two patents based on the hydrocracking of mixed plastic waste streams over zeolite catalysts to naphtha and diesel.