Catalysis making the world a better place

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In June 2015, a discussion meeting entitled ‘Catalysis improving society’ was held based around the research initiatives of the recently established UK Catalysis Hub. The title is very bold for a discussion meeting, and this is indeed true. However, it is hard to imagine the world today or indeed civilized society without the impact of catalysis on the fundamental aspects required for life, namely energy, food and water. Catalysis is a core area of contemporary science posing major fundamental and conceptual challenges. Traditionally, it lies at the heart of the chemical industry—an immensely successful and important part of the economy globally. Catalysis is generally associated with underpinning approximately 30% of gross domestic product in European economies. Catalysis is involved at some point in the processing of over 80% of all manufactured products. Hence catalysis is immensely important not only because it is an aid to economic success for the major world economies but also because it enables materials to be made that sustain society as we know it. Yet it is surprising that many outside of the field of catalysis science and engineering have no perception of its importance in their everyday lives. A central aim of the discussion meeting was to widen the awareness of the crucial importance of catalysis and also to set out where the future of this important field is heading.

At the heart of the chemical processes operated so successfully around the world has been the design of catalysts, and innovation in catalysis is core to meeting many of the key questions facing society as a whole today. Moreover, commercial success can only be sustained and grown through an innovation-driven approach which is grounded in the fundamental science and engineering underpinning new catalyst development. Indeed, current catalytic science is notable for both conceptual and technical innovation and there is a constant need to generate new catalysts and to design more efficient versions of current catalysts. This can be considered the core area in which catalysts currently operate. However, there is a broader arena in which we consider catalysis can...
play a wider role and impact more directly on society. Of course, the main area of catalysis that society has an appreciation of is the automobile exhaust catalytic converters which have improved air quality around the world for several decades. We anticipate that catalysis in the future will have a wider impact on achieving clean water, clean energy and sustainable food supplies in a far greater way than it currently does. The UK Catalysis Hub, established in 2013, has its origins in addressing these key areas of research.

The meeting addressed four key areas of current interest in catalysts:

- Catalyst design—is it possible to design new and improved catalysts?
- Catalysis and the environment—how can catalysis improve our use of resources?
- Catalysis and chemical transformations—how can we improve the scope, efficiency and selectivity of chemical processes?
- Catalysis and energy—how can we improve energy efficiency using catalysis?

These discussion themes are based on the initial research themes established in the UK Catalysis Hub. An array of world leading scientists and engineers together with early career researchers took part in this discussion meeting attempting to answer some of these key questions. A satellite meeting followed the discussion meeting and this was entitled ‘Catalysis making the world a better place’. This was a discussion meeting addressing four key questions which we hoped will help steer the future direction of the UK Catalysis Hub and the field of catalysts research in general. The questions posed were: Is catalysis really sustainable? Can catalysts be designed using theory? Energy as a key resource—what role can catalysis play? Renewable resources—what role can catalysis play in their sustainability?

Many present at these meetings have now written articles for this issue of Philosophical Transactions of the Royal Society A. In bringing these articles together we aim to show how the breadth of current catalysis research is addressing the important issues that face society today. Our aim is to show the confluence of chemical, engineering and bioscience concepts and ideas that make catalysis the modern multidisciplinary field that it is today. ‘Catalysis improving society’ represents how new areas of this important contemporary field are addressing both the existing and new requirements of society.