

Editorial

Michael Bowker

To cite this article: Michael Bowker (2015) Editorial, Catalysis, Structure & Reactivity, 1:1, 1-3, DOI: [10.1179/2055074X14Z.0000000003](https://doi.org/10.1179/2055074X14Z.0000000003)

To link to this article: <http://dx.doi.org/10.1179/2055074X14Z.0000000003>



© W. S. Maney & Son Ltd 2015



Published online: 30 Nov 2014.



Submit your article to this journal [↗](#)



Article views: 245



View related articles [↗](#)



View Crossmark data [↗](#)

Editorial

Michael Bowker

Cardiff Catalysis Institute, School of Chemistry, Cardiff University, Cardiff, Wales, Email bowkerm@cardiff.ac.uk

Catalysis is a far more important technology in the current era than ever it has been. With a need for mankind to change its energy usage and global footprint we need to make rapid developments in the field, both by improvements to current processes and by innovation. It is notable that one of the most intense deniers of man-induced climate change in recent years, the US government, has finally relented and the US Secretary of State, John Kerry, has bravely resisted a number of lobbying organizations to make the following statement in response to the recent UN Intergovernmental Panel on Climate Change report.¹ 'The bottom line is that our planet is warming due to human actions, the damage is already visible, and the challenge requires ambitious, decisive and immediate action. Those who choose to ignore or dispute the science so clearly laid out in this report do so at great risk for all of us and for our kids and grandkids.'

In light of such statements, it is inevitable that internationally binding legislation will be applied in the near future to mitigate the use of fossil fuels, or at least to reduce their impact on atmospheric CO₂. Such legislation is the impetus to science, and to catalysis in particular, just as it was for the reduction in polluting emissions from vehicles – one of the great successes of modern catalytic technology. The underpinning work for revolutions in chemical processes and in fuel production, has been proceeding over the last few years and some of the papers in this inaugural issue of *Catalysis, Structure & Reactivity* relate to such efforts.

To enable these rapid developments we need to apply the utmost of our ability and inventiveness to the task. To go with this we need to utilize a range of new techniques and concepts to the understanding of catalysis, because ultimately, and surely, catalysis cannot be a 'black art', and the new advances will happen through design based on real and expanded knowledge.

It is our aim that this journal is part of that process of knowledge expansion and the aim is to uniquely bring together the realms of expertise, as shown in Fig. 1. Industrial application in catalysis is built on a foundation of the fundamental disciplines of chemistry, physics, mathematics and materials science. The latter can perhaps be considered to be a subdiscipline of the former three. These then make the basis for the more specialized areas of surface science, nanoscience and theory upon which catalysis, both fundamental and applied, is built (Fig. 2) and which ultimately lead to new industrial processes.

This journal aims to bring together these areas to highlight the contributions of surface science, nanoscience and theoretical modelling to the field, since these are intimately related and inseparable (Fig. 2). We look too for fundamental contributions on developments in industrial, applied catalysis itself. If we want to give a broad description of the areas covered by the journal, it

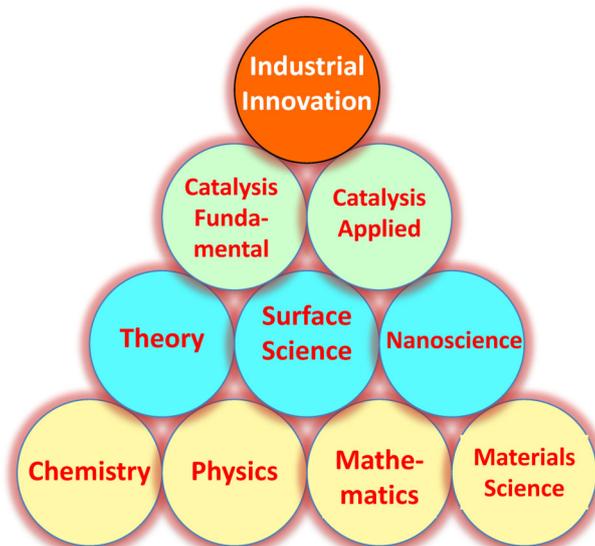


Figure 1 Foundation disciplines underpinning catalytic innovation

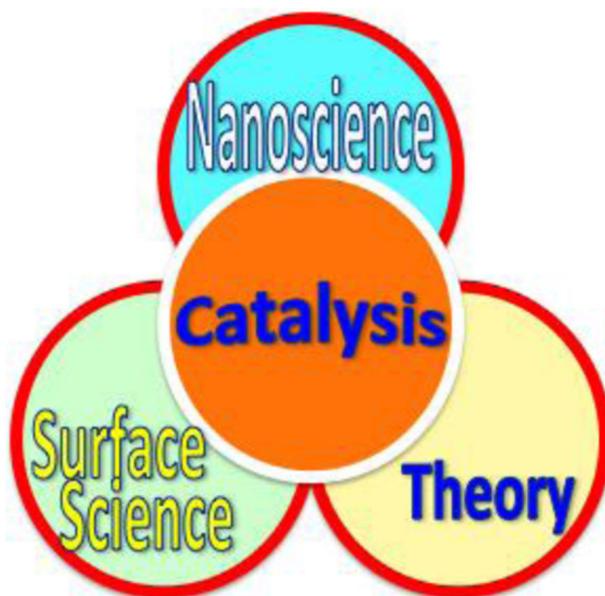


Figure 2 These four fields are interconnected

would be the physical chemistry of catalysis. The atomic and nanoscale structure of materials used as catalysts significantly influences their performance, and correlating structure with activity is crucial for catalyst optimization and innovation. Modern catalyst research increasingly involves, and requires, an understanding of catalyst behavior *in situ*, and recently, *in operando* methods have begun to revolutionize the field. This journal will report the latest advances in structure–function relationships in catalytic science, in particular the application of modern measurement science to understanding catalyst materials and their function, including the use of nano- and microscopies, *in situ* nuclear magnetic resonance (NMR) and combined optical spectroscopic methods, alongside traditional techniques. We hope to also emphasize the role of synchrotron radiation and neutrons in such developments, including the new tools working under operating conditions. With the advent of these new methodologies and atomic level imaging methods such as ac-TEM and scanning tunnelling microscopy (STM), it is envisaged that we can finally crack the problem of ‘seeing’ the active site as it turns over reactants into products.

The journal particularly welcomes research articles at the interface between chemistry, materials science and chemical engineering, and those which describe the development of new and improved catalysts, and the translation of catalysis research from the atomic to the industrial scale.

In our first issue we have papers covering a number of the topics described above, including photocatalytic hydrogen production, understanding selective oxidation, aspects of diesel exhaust catalysis, support–metal interactions and the role of promoters, and they are from both theorists and experimentalists. All of these contributions are aimed at the ultimate understanding of catalytic processes which must be the foundation for technological and environmental improvements.

The paper from the Keane group at Heriot-Watt² concerns the role of the support in influencing catalytic selectivity, and shows a very marked effect for the hydrogenation of butyronitrile. This is another reminder that there are probably few reactions where the support is merely that, an inert refractory material for maintaining metal particle size. In a somewhat related vein, Jones *et al.*³ report that the activity of Pd nanoparticles can be manipulated for formic acid decomposition by anchoring amines to the support, which then interact with particular sites on the Pd. Beale and his colleagues⁴ report data for diesel exhaust clean-up, and use a combination of bulk and surface techniques to illuminate the role of the surface-active components (W,V) which are present on the surface of such catalysts: a major role of W is to stabilize V in a surface oxide layer, and the importance of V oxide in monolayer form is emphasized.

We have several theoretical contributions. Van Steen and Claeys⁵ report on the important role of Cu in Fischer Tropsch catalysis on Fe, and in particular on one of the proposed carbidic phases thought to be present during synthesis, and it manifests a complicated relationship. That is, dispersed Cu appears to aid CO dissociation, but yet it prefers to be in the nano-particulate state rather than in atomically dispersed state, at least in the presence of CO alone, thus lessening any promoter effect of this kind under these circumstances. Our own group reports results for photocatalytic hydrogen production using specially prepared catalysts based on sol-immobilisation.⁶ In this way, colloidal particles of Au–Ag alloys can be preformed and then deposited onto photo-active titania, and it is shown that there is some improvement in activity for the alloy compared with the mono-metallics, but that exact sequence of the preparation method is important for activity.

We are delighted to begin our journal with such excellent papers from quality research groups around the world, and anticipate the growth of submissions and contributions to the field of catalysis. In this way we would hope to play our part in advancing the field.

Professor Michael Bowker

Editor-in-Chief

References

1. Climate change 2014, synthesis report, available at: http://ipcc.ch/pdf/assessment-report/ar5/syr/SYR_AR5_LONGERREPORT.pdf
2. Y. Hao, X. Wang, N. Perret, F. Cárdenas-Lizana and M. A. Keane: *Catal. Struct. React.*, 2015, **1**, 4–10.
3. S. Jones, A. Kolpin and S. C. E. Tsang: *Catal. Struct. React.*, 2015, **1**, 19–24.
4. A. M. Beale, I. Lezcano-Gonzalez, T. Maunula and R. Palgrave: *Catal. Struct. React.*, 2015, **1**, 25–34.
5. E. van Steen and M. Claeys: *Catal. Struct. React.*, 2015, **1**, 11–18.
6. J. Kennedy, W. Jones, D. J. Morgan, M. Bowker, L. Lu, C. J. Kiely, P. P. Wells and N. Dimitratos: *Catal. Struct. React.*, 2015, **1**, 35–43.