Preface for the Issue of Topics in Catalysis Memorial Issue Dedicated to Professor Michael S. Spencer

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This issue of Topics in Catalysis is dedicated to the memory of the much liked and admired Mike Spencer who passed away on 3 April 2020 at the age of 88 after successfully working on catalysts and catalysis for more than 60 years in industry and in academia—he was responsible for a wealth of significant contributions to catalysis.

Throughout his life Mike Spencer worked hard in a dedicated conscientious way. He was at school during and just after World War II and he excelled in mathematics and science subjects. He won a scholarship in his last year at school which was followed by a major scholarship at Emmanuel College, Cambridge. After completing a PhD on the kinetics and mechanisms of gas phase reactions in 1957 he married, left Cambridge and went to work at the coal-based Imperial Chemical Industries (ICI) site at Billingham in the North East of England. Here ammonia, the main product, was manufactured via a series of catalytic reactions and he embarked on what would be a six decade career in catalysis with half of it at ICI Billingham and half, after formal retirement, at Cardiff University.

The Research Department at Billingham was a substantial vibrant centre of international repute focused on developing new catalysts for industrial processes to be operated there. A few years after Mike Spencer started there major catalyst advances were made that enabled the introduction of large single stream ammonia and methanol plants based on the steam reforming of hydrocarbon feedstocks. He had considerable involvement in the development of zeolite catalysts when ICI was exploring potential applications for their new zeolites but his central research theme became centred on copper catalysts and the mechanisms of reactions on their surfaces. Copper catalysts developed at Billingham were used to convert residual carbon monoxide to valuable additional hydrogen in ammonia and hydrogen plants and the

conversion of synthesis gas to methanol at relatively low temperatures.

In addition to other work on catalysis Mike Spencer authored or co-authored some 40 research papers and reviews on copper catalysts that gained him an international reputation. A significant part of what he did was numerical and he had a distinctive way of meticulously applying fundamental concepts to complex situations that gave insight and understanding. An important practical achievement was showing over industrial copper methanol synthesis catalyst under industrial operating conditions methanol is synthesised from carbon dioxide rather than the previously assumed carbon monoxide. As a result surface formate was implicated as an intermediate in the synthesis mechanism and this was later confirmed.

Professor Hajo Freund of the Fritz Haber Institute in Berlin knew Mike Spencer mainly through his association with Cardiff University and he suggested the appropriateness of having an issue of Topics in Catalysis dedicated to him. The idea was enthusiastically endorsed by friends and colleagues as a fitting tribute and during discussions with possible contributors it became apparent how many had been helped, encouraged and supported by Mike Spencer when their careers were at an early stage, often through “fatherly conversations”. There are contributions from colleagues who worked alongside Mike Spencer at ICI in Billingham and many from others who knew him at Cardiff University. A few people who intended to contribute were unable to because of unforeseen circumstances, but everyone maintained strong support for the project.

Papers appear roughly in the order the lead authors knew Mike Spencer or associated with his work at ICI followed by those who knew him at Cardiff University. The first group includes John Birtill, Martin Fowles, Martin Hayes, David Jackson, Bob Jennings, David Parker, Julian Ross, and Martyn Twigg. Amongst authors who knew Mike Spencer at Cardiff University are Jonathan Bartley, Robbie Burch, Philip Davies, Hajo Freund, Stan Golunski, Justin

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Hargreaves, Graham Hutchings, Simon Kondrat, David Lennon, Stuart Taylor, Peter Wells and Keith Whiston.

The range of topics covered is very wide and in the first group there are several unique contributions from industrialists about work done at the time Mike Spencer was at ICI that give insights into the huge amount of time and effort that goes into the development of industrial catalysts and some of the less than obvious important considerations. For instance, catalyst life is very important and with exothermic reactions high activity catalyst is usually less important than having liberated heat at a temperature sufficient to raise high pressure steam to optimise energy recovery.

Thanks are due to all the contributors and to the many that worked with or knew Mike Spencer who gave reminiscences

which are incorporated in the opening biographical paper. The Reviewers were immensely helpful and constructive in their comments that guided authors to improve their papers. The positive help and understanding of all those involved at Springer and especially Matthew Smyllie in the Heidelberg office was very important and is gratefully acknowledged.

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