



## Preface

## Foreword

Prof. Yuan Kou may be best known at this time for his research on the nanoscale, but his contributions to science over the years has been huge, despite a rather unconventional scientific career. Indeed, Yuan Kou did not follow a typical path to his current position of full professor at Peking University due to political turmoil in China during his informative years. Born in Beijing on July 20, 1947, the city where he received his early education, as Yuan Kou was preparing to enter higher education all the universities in China were suddenly closed. Consequently, he left high school in 1968 and worked as a caster in a factory in Lanzhou for the next 8 years. In 1977 the universities were allowed to re-open and Yuan Kou immediately entered Lanzhou University to study chemistry (1977–1981). As graduate education programs remained closed at that time, instead of progressing to a PhD, he joined the Lanzhou Institute of Chemical Physics in 1982 where he studied homogeneous catalysis. Yuan Kou made a strong impression on his colleagues, proving to be a highly talented and industrious researcher, and his research was soon generating considerable attention within the institute. As a result of his accomplishments in 1986 he was given the opportunity to broaden his research interests in Japan, working in the Takasago Institute and studying organometallic chemistry with Prof. Sei Otsuka at Osaka University. During this period in Japan Yuan Kou formed life-long friendships and collaborations – indeed a feature which extends to his entire career. When graduate education recovered in China Yuan Kou returned to Lanzhou Institute and obtained his PhD in 1991, at the age of 43, under the guidance of Prof. Hong-li Wang. His thesis was entitled, 'Preparation and XAFS Characterization of Supported Dodecarbonyl Triiron and Its Highly Dispersed Derivatives'.

From now on Yuan Kou's academic career moved extremely rapidly, no longer hampered by external influences, but based on his own abilities and talent as a researcher he became a full professor at the Lanzhou Institute within 5 years. His application of XAFS to provide fundamental insights into supported catalysts received widespread attention both in China, and beyond, and in 1997 he was invited to join the faculty of Peking University where he has remained ever since.

The initial research interests of Yuan Kou were primarily concerned with elucidating atomic level information on heterogeneous supported catalysts using XAFS (1986–1997). In a series of seminal papers he demonstrated that by introducing homogeneous coordination chemistry onto a heterogeneous surface the dispersed structure of supported catalyst based on XAFS analysis could be revealed, and he coined the expression surface coordinate geometry to describe this phenomenon. While many other groups were using XAFS to study supported catalysts at that time, Yuan Kou's

work was among the few that provided a clearer picture that allowed the behavior of the catalyst at the atomic level to be better understood.

In 2002, Prof. Kou realized that the two-dimensionally bound structure of a supported catalyst restricted on a semi-spherical surface represents an intrinsic limitation of heterogeneous catalysts. He wrote in a review for *Catalysis Today* that stated, 'immobilization of a catalyst, for example, a metallic catalyst, by supporting it in an ionic liquid rather than on a surface may create highly free, three-dimensional centers allowing a traditional gas–solid phase heterogeneous catalytic process to be performed at a gas–liquid–solid interface.' This important review has since been cited over 600 times, and in part set the scene for the rapid growth in field, i.e. nanoparticle (NP) catalysis or nanocatalysis as it is now often called. In 2005 Yuan Kou published another landmark paper that described a Rh NP catalyst that catalyzes the hydrogenation of benzene with an unprecedented turnover number exceeding 20,000. The activity of this nanocatalyst was described as having an 'unprecedented lifetime' by *C&E News*. Following that publication a series of papers reporting highly active transition metal NPs emanated from Yuan Kou's laboratory. A variety of different reactions were studied, and probably the most successful example, as immediately highlighted by *Chemistry World* and elsewhere, was a Ru NP catalyst for Fischer–Tropsch synthesis in water. This work was not only of academic curiosity but the patent was transferred to industry for further development and implementation.

It is not possible to describe all the contributions of Yuan Kou to catalysis: his research includes homogeneous catalysis, heterogeneous catalysis and nanocatalysis. He has worked on amino acid-based ionic liquids, biomass conversion and green chemistry. Although he has only become interested in certain topics quite recently, Yuan Kou has made considerable advances to these fields, and his creativity and original ideas have inspired many others across the globe. In the area of biomass conversion, for example, tailored catalysts developed in his group have been used for the selective hydro-degradation of both cellulose and lignin with the ability to catalyze 'the precise breakdown the C–O–C bonds', described as a 'chemical breakthrough' by the *New Scientist*. Indeed, this approach opens the door for the effective transformation of lignocellulosic materials into fuels and fine chemicals. The fully green ionic liquid families derived from natural amino acids that Yuan Kou developed have also proven to be of high interest within the community.

Yuan Kou is not just a prolific researcher, he is also a superb teacher and mentor and has cemented many long-standing friendships during the course of his scientific activities. Many of his

former graduate students and postdoctoral fellows now hold senior positions in academia and industry. Since 2004 he has taught the course *Fascinating Chemistry* to all undergraduate students at Peking University. Indeed thousands of students should remember his dynamic and descriptive introduction to modern chemistry. Yuan Kou has also played a leading role in directing science policy in China establishing the committee on green chemistry for Chinese Chemical Society since 2002, which he continues to chair until this day.

Prof. Yuan Kou has been incredibly active over the 15 years that he has been a full professor at Peking University and now he has reached the age of 65. This is a landmark age, and the reason for publishing a special issue of *Catalysis Today* in his honor. However, for Yuan Kou it is just another birthday and there are not any signs that he will retire or even slow down. Yuan Kou remains, and will continue to remain for many years to come, as an active, and innovative scientists, and one who gives generously to those around him and to the chemical community more broadly. We believe that this

special issue is a fine tribute to a creative researcher, deep thinker, outstanding teacher, dear friend and colleague, and a wise man. Yuan Kou, we congratulate you on a marvelous first 65 years and hope that you continue to do what you enjoy most for many years to come.

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