

Helmut Knözinger (1935–2014)

Professor Helmut Knözinger, an internationally leading scientist in catalysis and surface spectroscopy died on January 14, 2014 in Munich.

Helmut Knözinger was born on July 10, 1935 in the small town of Weilheim located in one of the most attractive regions of upper Bavaria, and the place where Wilhelm Röntgen, who first discovered X-rays, owned a country house. This might well explain Helmut's lifelong attachment to Bavaria and its capital Munich, as well as photography and science.

After obtaining his "Abitur" (1953) and completing his undergraduate studies in physics at the Ludwig-Maximilians-Universität (LMU) München, Helmut was persuaded by Professor Georg Maria Schwab, one of his teachers and an early pioneer of heterogeneous catalysis, to abandon the idea of becoming a professional photographer and instead to join his team to carry out a PhD. Under his mentorship, Helmut enjoyed an unusual freedom, a fact that he often liked to mention and something that he himself later transferred to his students and co-workers. He always encouraged them to develop their own ideas.

Helmut obtained his doctorate on the catalytic decomposition of methyl formate and its use as a probe reaction in 1961, marking the beginning of a most successful scientific career starting with a teaching assistantship in 1962. After a postdoctoral thesis and his habilitation in 1966 on the dehydration of alcohols on alumina, he became "Privatdozent" in 1967. He extended his habilitation work by using a broader range of alcohols (primary, secondary, tertiary, alicyclic), deuterium labeling, and appropriate catalyst poisons. This allowed him to unravel the kinetics and mechanism of the reactions.

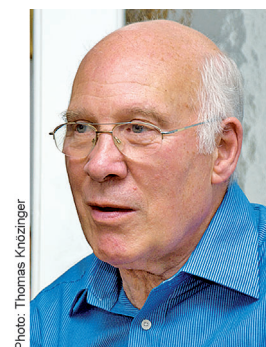
In 1973, he was made associate professor at the Institute of Physical Chemistry (LMU) for his seminal achievements in catalysis and surface spectroscopy. He always remained loyal to the Institute, despite several attractive external offers. On the basis of his considerable expertise in physical and surface chemistry, he organized engaging lectures. It was customary to hear at LMU that no undergraduate could leave the chemistry department without attending Knözinger's courses on vibrational and surface spectroscopy! He officially retired in 2000, but remained active in research until the end of his life.

Because of his background in physics, he quickly realized that surface spectroscopy with its large spectrum of physical techniques (notably vibrational spectroscopy) allowed a privileged access to the structure of catalyst surfaces and adsorbed species, the interactions between the

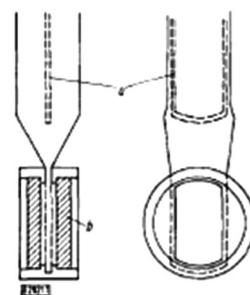
latter, and thus the functioning of heterogeneous catalysts. To achieve those goals, he developed the use of molecular probes to determine the concentration, nature, and structure of the catalytically active sites. These probes had to exhibit two features that is, 1) to be small enough to allow all the sites to be counted and 2) to interact as weakly as possible with the surface sites to reveal the original structure of the sites. These probes included CO, NO, N₂, NH₃, H₂ as well as C–H acids and allowed the assessment of surface acid–base (Lewis and Brønsted) properties, as well as oxidation and coordination states of surface metal ions and/or atoms.

By using the molecular probe approach as well as conventional and spectroscopic techniques (including an IR cell to investigate gas adsorption on various wafers), often in combination, Helmut investigated a large number of catalytic reactions (including dehydration, hydroxylation, selective oxidation/reduction, hydrogenation, cracking, isomerization, reforming, and hydrosulfurization), bulk and oxide-supported compounds (notably oxides, zeolites, sulfides, metals, carbonyl metal compounds, or polyoxometalates), and phenomena (adsorption, both catalytic as well as physical, such as solid–solid wetting). In his work, his goal was always the correlation of the physicochemical characteristics of a model catalyst with its catalytic properties in order to understand its function, thereby offering the possibility to design an even better catalyst. Apart from his work on acid–base properties, on which he became one of the leading experts, another example is his seminal work on the low-temperature isomerization of *n*-alkanes and his search for better catalysts, which led to around 30 papers. Starting with zirconia as support, and after a stepwise approach toward 100% selectivity for the isoalkane, he developed a catalyst made of sulfated/tungstated zirconia promoted with platinum. Other examples include supported vanadia for deNO_x chemistry and selective oxidation, promoted alumina-supported molybdena systems for hydroprocessing, and the phenomenon of solid–solid wetting as a method to prepare catalysts.

Helmut published about 440 papers in the best chemistry journals, 3 patents, nearly 80 reviews, and 24 books or book chapters that were cited more than 13000 times. The most famous and influential publications are his Review with P. Ratnasamy "Catalytic aluminas: surface models and characterization of surface sites" (*Catal. Rev.* **1978**, 17, 31), cited around 1500 times, and the book *Handbook of Heterogeneous Catalysis* (both as author and Co-editor, with Ertl and Weitkamp in 1997, and with Ertl, Weitkamp, and Schüth in 2008), nowadays the classic reference work in the field. Because of his expertise in catalysis and surface spectroscopy, he served as an Editor of *Advances in Catalysis*



Helmut Knözinger



(1998–2011) together with B. C. Gates and F. C. Jentoft, and on numerous editorial boards (e.g. *Catal. Rev.*, *Appl. Catal. B*, *Catal. Lett.*, *Catal. Today*, *J. Catal.*, *Topics Catal.*).

Helmut's outstanding work earned him many invited plenary lectures (notably at the 9th International Congress on Catalysis, Calgary in 1988) and awards, including the Ciapetta (1980) and Ipatieff (1988) Lectureships (USA), Max Planck Research Award (1995), Gay-Lussac Prize of the Alexander von Humboldt Foundation (1997), and Alwin Mittasch Prize from Dechema (1998). He became a Foreign Member of the Hungarian Academy of Sciences in 1995, and Member of the Academia Europaea in 2000. He was invited to many universities as guest professor, including Caracas (1968/1969), Xiamen (1985), Nankai (2003), Amsterdam (1989), and Paris (1995, 1996, 1997, 2001).

Helmut also very actively served the scientific community at the national, European, and international levels. He was Deputy Chairman of the catalysis section of Dechema (Society for Chemical Engineering and Biotechnology) from 1993 to 1996 and its Chairman from 1996 to 1999. He was the German representative at the Council of the European Federation of Catalysis Societies (1993–1999) and at the Council of the International Congress on Catalysis (1984–1996), and thus largely contributed to the organization of the International Congress on Catalysis in Berlin in 1984. He became Vice-President (1995–1996) and then President (1996–2000) of the International Association of Catalysis Societies.

Under the inspired leadership of both Professors Schwab and Knözinger, the catalysis laboratory in Munich remained a famous center for more than six decades, attracting a large number of

students, postdoctoral fellows, and visiting scientists from all over the world. Helmut had a talent for organization and thus could plan and work on several subjects at the same time. Those who attended the solar eclipse with him in August 1999 were the beneficiaries of this talent: Helmut selected the best place at the top of a hill close to Munich and, to avoid any eye problems, managed, thanks to an ingenious setup, to show the event on a screen, accompanied and celebrated with traditional "Weißbier" and "Bretzels".

Helmut had a happy family life with his charming wife Rosemarie. They both had an acute sense of hospitality and liked to invite students (who used to call Helmut "Knö"), post-docs, and visiting scientists to their beautiful house and garden. There one could enjoy tasty food, wine, and beer and admire the beautiful pictures taken by Helmut with his famous Nikon D80 camera during their many trips, particularly to Africa.

He died peacefully on a Sunday, after a major work had been completed. In his dealings with both the younger and older generations, Helmut always behaved with gentlemanly decency and generosity of spirit. The scientific community will remember him as a genuine, warm-hearted, elegant and generous character, and all will continue to be inspired by his broad and insightful science.

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DOI: 10.1002/anie.201407227

