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Gerhard Ertl: Congratulations!

With this year's Nobel Prize in Chemistry, both a life achievement and a person are honored, a person who has, like no one else, influenced surface science from its modern beginnings until today. Gerhard Ertl, emeritus scientific member and director at the Fritz-Haber-Institut of the Max-Planck Society in Berlin, Germany, the scientific great-grandson of the founding director, whose name the institute carries, has received notice of the "ultimate award" on the occasion of his 71st birthday, October 10th, 2007. The occasion was celebrated by his collaborators, colleagues, friends, and students, and a whole cadre of journalists.

Prior to this year, the previous Nobel Prize that went to the FHI was given to Ernst Ruska, the inventor of electron microscope, in 1986. During the almost 100-year history of the institute, other Nobel laureates have worked there, namely, Fritz Haber, James Franck, Otto Hahn, and Max von Laue. There is a scientific genealogy at the institute connected to this year's laureate: Gerhard Ertl's thesis advisor was Heinz Gerischer, a prominent electrochemist and a former director of the institute. Gerischer was a student of Karl Friedrich Bonhoeffer, who headed the institute in the post-world war II period, and who himself was a Fritz Haber student. There is also a scientific loop closing with Gerhard Ertl's Nobel Prize: Fritz Haber had discovered the process to make ammonia from nitrogen in the air during 1905–1908, which was then commercialized by Bosch within BASF. Haber received the Nobel Prize in 1918 accompanied by the remark that with his discovery he had saved Europe from starvation.

The following more than 50 years were marked by attempts to explain the mechanism of splitting one of the strongest known bonds between two nitrogen atoms via interaction with the surface of an iron-based catalyst. In 1975, Paul Emmett, himself an eminent physical chemist, wrote: "The experimental work of the past 50 years leads to the conclusion that the rate determining step in ammonia synthesis is the chemisorption of nitrogen. The question, however, as to whether the nitrogen species is molecular or atomic, is still not conclusively resolved".

Shortly thereafter, Gerhard Ertl and his group, having applied the methodology of surface science, showed that the species that is hydrogenated stepwise to ammonia is atomic nitrogen. Those experiments documented elegantly Gerhard Ertl's ability to capture the essence of a complex process and condense it into a "simple" experiment. The mystery of the mechanism of ammonia synthesis was disclosed 70 years after Haber's discovery.

The search to understand the atomic structure and the dynamics of solid surfaces under the influence of adsorbates (often molecules from the gas phase) dominated Gerhard Ertl's research efforts. He had always developed or adapted new analytical tools as they became available and, in an ingenious way, combined them to extract "physically exact" results. The reaction studied most in Ertl's group is CO oxidation on precious metal surfaces. In 1982 the group reported on kinetic oscillations in CO_2 production during the CO oxidation reaction on metallic single crystalline surfaces, a phenomenon observed previously only within technical chemical reactors.

Within a series of groundbreaking publications, Ertl's group demonstrated the connection between adsorption of carbon monoxide and oxygen and the reconstruction of the surface. The reaction and the higher probability of adsorption on the non-reconstructed surface lead to a switching between the reconstructed and the non-reconstructed surface and, thus, to kinetic oscillations. Such oscillations can be regular, irregular, or even chaotic. These represent the integral behavior of the system. However, it is known from the Belousov–Zhabotinsky reactions that the oscillations exhibit a spatio-temporal behavior. Ertl's group developed a photoelectron microscope to image spatio-temporal structures such as spirals and chemical waves on solid surfaces for the first time. Together with theorists the group also developed a microscopic understanding of these non-linear dynamic phenomena.

When studying elementary reactions on solid surfaces, it is also extremely informative to achieve the highest possible time resolution. Ertl established a group dealing with "pump-probe" experiments employing laser spectroscopy at femtosecond time resolution. Such experiments have led to new insights in electron dynamics and energy transfer at solid surfaces. Another excellent example for a new "old" technique in surface electrochemistry pushed forward in Gerhard Ertl's group is tip-enhanced Raman spectroscopy. There are clear recent indications that it is possible to reach the single molecule limit, which opens a myriad of possibilities in many areas of physical chemistry and surface science.

Gerhard Ertl has published about 700 papers and several books, and he has presented several hundred invited talks.

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A full compilation of his activities throughout 2004, the year of his retirement, can be found in "Festschrift" on the occasion of his 68th birthday (*Journal of Physical Chemistry B*, 108, 14183–14788 (2004)). The list of awards is very long and it is impossible to list them all, but three that come to mind are the Liebig—Medal of the GdCH, the Japan Price, and the Wolf Price and now, the ultimate honor of which he is the sole recipient in chemistry this year!

Gerhard is still very active. He is writing a book after he just held the Baker lecture at Cornell. The second edition of the *Handbook of Heterogeneous Catalysis* is almost completed and so his work goes on ..... He and his wife Barbara enjoy music, with him playing the piano when Barbara's choir rehearses. They also enjoy spending time with their grandchildren as well as at their second home in Bavaria in addition to the one in Berlin.

The surface science community and all members of the board of *Surface Science Reports*, of which he was a member for many years—are extraordinarily happy for him.

Congratulations Gerhard!

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