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PREFACE

Temkin Mikhail (Menassii) Isaakovich 16.09.1908–01.10.1991

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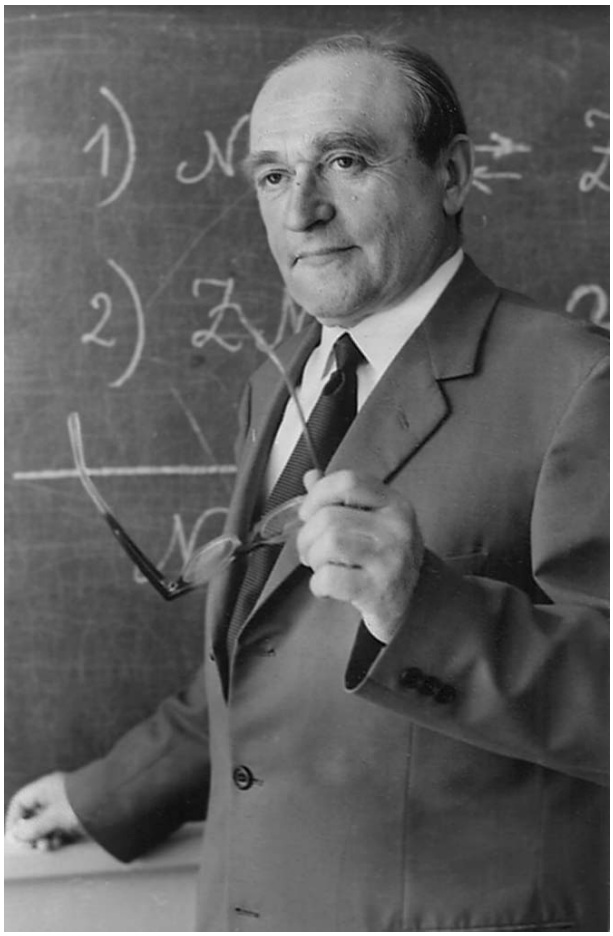

Mikhail Isaakovich Temkin, an outstanding scientist who made a great deal in the field of physical chemistry and chemical physics, was born September 16, 1908 in Belostok (Russia; now Bialystok, Poland). He graduated from the Lepeshinskii school in Moscow in 1926. At that time, to continue his education at the university, one had to work first in industry for two years. M.I. Temkin spent this period at a Moscow chemical plant, which, in his own words, had a positive effect on his whole life, directing his future scientific research towards practical problems.

Mikhail Temkin graduated from the Faculty of Chemistry of the Moscow State University in 1931. Since 1932 to the end of his life, he worked at the Karpov Institute of Physical Chemistry (KIPC), except for a small gap in 1935 when he visited the laboratory of M. Polanyi in Manchester. Mikhail Issakovich had founded the laboratory of chemical kinetic at KIPC in 1932 and headed it for 50 years.

Fruitful scientific activity of M.I. Temkin was devoted to different scientific fields. His main studies pertain to thermodynamics, chemical kinetics, catalysis, and electrochemistry. It can be said without exaggeration that Temkin was among those scientists who developed the basics of modern physical chemistry and, particularly, heterogeneous catalysis.

The beginning of Temkin's scientific activities was very bright. In 1938, he applied for the first time the transition state theory to heterogeneous catalytic processes. Soon after this (1939), he published his famous

study in cooperation with V. Pyzhev on the catalytic synthesis of ammonia, which obviously still remains the most often cited work in this field. The derived equation for synthesis rate named the Temkin–Pyzhev equation is still used in optimizing the technology of ammonia synthesis and occupies an important place in the theory of heterogeneous catalysis. In the study by Temkin and Pyzhev, the concept of adsorption as the rate-determining stage of a catalytic process was formulated for the first time. In contrast to ideas of Langmuir and Hinshelwood that dominated for a long time, in this study, it was assumed that the adsorption heat decreases linearly with the increase in the surface coverage with adsorbed species (nitrogen molecules). As a result, the catalytic surface was described for the first time as biographically nonuniform; moreover, in the further studies by Temkin and his school, this approach was extended to a large number of important catalytic reactions (propylene ammanoxidation, nitrobenzene hydrogenation to aniline, steam and dry methane reforming, and several other processes). The deep insight into the mechanism of interaction of gaseous reactants with the surface had allowed Temkin to propose a method of passivation and extra-column reduction of the catalyst employed in the ammonia synthesis, the method used today in industry. In 1978, Temkin was awarded the State Premium of the USSR in the field of science and technology for the elaboration of kinetic models of industrial heterogeneous catalytic reactions.

It is difficult to overestimate the fundamental significance of studies by M.I. Temkin. Among his most important results, one can mention the evidence that the linear relationship between the heat of adsorption and the activation energy, which was known earlier for homogeneous reactions, can be also applied to heterogeneous catalytic processes. Yet another contribution into the kinetics of chemical reactions, which is of no less importance, was associated with the elaboration of the theory of complex steady-state reactions (the Horiuti–Temkin theory) to be applied to homogeneous and heterogeneous reactions, catalytic processes, chain processes, etc. Temkin developed an approach that made it possible to approximately assess the efficiency of a catalyst for single-route reactions with the kinetics described by an arbitrary equation.

The development by M.I. Temkin of a model of uniformly heterogeneous surfaces deserves special comment. In 1941, based on experimental results obtained by A.N. Frumkin and A.I. Shlygin on the hydrogen adsorption on a platinized platinum electrode, Temkin substantiated the logarithmic isotherm of adsorption for systems with the heat of adsorption linearly decreasing with the increase in the surface coverage with adsorbate. In scientific literature, this isotherm is referred to as the Temkin isotherm. In addition to the concept of biographic heterogeneity of the surface, the logarithmic isotherm can be also substantiated within the framework of the surface electron gas theory, which was also successfully elaborated by Temkin to be used in getting insight into the phenomenon of adsorption layers.

Theoretical concepts on the kinetics of reactions on heterogeneous surfaces were extended by Temkin to the kinetics of electrode processes, particularly, by the example of the hydrogen electrolytic generation. The first correct attempts to apply the transition state method to electrode reactions also belong to Temkin. He performed the first comprehensive analysis of the concept "activation energy of an electrode process" to afford a relationship between the so-called true and real activation energy of which the former corresponds to a process at a constant Galvani potential and the latter pertains to a process at a constant overpotential.

The ionic theory of mixtures of molten salts with metallurgical slag (Temkin model of melts) within the framework of which a concept of the ideal ion solution (the Temkin rule) was formulated is universally acknowledged. This model allows one to find the distribution of chemical elements between fused iron and slag, which solves one of important problems of metallurgy. The Temkin–Schwartzman method of calculation of chemical equilibria is widely known.

Mikhail Temkin was also the first to consider the entropy of a moving ion and carry out fundamental studies of thermoelectric phenomena in electrolyte solutions.

Finally, Temkin's results important for the fuel cell theory, obtained by modeling the ionization of gaseous reactants on partly immersed electrodes, deserve mention.

Mikhail Temkin focused attention on the development of experimental methods in kinetics and catalysis. In his laboratory, the flow-through circulation method was developed for studying heterogeneous catalytic reactions (1950), which allows one to study these reactions in the absence of temperature and concentration gradients. This method has received wide acceptance in the scientific research practice. Temkin was the first to employ the method of secondary ion-ion emission and also the isotopic and nonstationary methods.

Mikhail Temkin is the author of more than 350 scientific papers and inventions. He also dwelled into pedagogical activities as the Professor of the Moscow Institute of Steel and Alloys, where he read lectures for postgraduates and researchers. His pupils include several dozens of candidates and doctors of sciences.

For his outstanding merits, M.I. Temkin was awarded the Order of the Red Banner of Labor (twice) and the Order of the Badge of Honor, many medals, was given the title "Honored Chemist". His studies are highly acknowledged by the international scientific community and his main ideas had entered into manuals and monographs.

Mikhail Isaakovich undeniably belonged to the scientific elite of Russia, combining the wide scientific outlook and creativity with extremely wide knowledge in the field of literature and art. His favorite author was

Saltykov-Shchedrin, and he knew by heart large fragments of his books and could artistically quote them the more so that the surrounding life gave many occasions for referring to this author. In a similar style, i.e., poignant and using precisely chosen words, he communicated with his friends and colleagues, jauntily bestowing those around him upon winged words and expressions to be cited for a long time. Long-term scientific contacts between A.N. Frumkin and M.I. Temkin brought Mikhail Isaakovich close to many electrochemists of his generation, which was beneficial for the interpenetration of ideas of electrochemistry, kinetics, and catalysis.

We hope that this special issue will make a small additional contribution to the acknowledgement of scientific merits of M.I. Temkin and will not be lost by the background of his worldwide recognition.

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