Physical Chemistry Crossed the Boarder: Influences of Physical Chemistry in the German Chemical Industry, 1900-1950

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Before the turn of 20th century the German chemical industry was heavily influenced by the knowledge and the modelling approaches of organic chemists.[1] Although there were some chemical engineers in the industry, their influence regarding a more quantitative approach in industrial design was limited by the predominance of organic chemists. Originally caused by organic chemical constraints to enable various chemical reactions to obtain different dyes, the very important "oleum" (sulphuric acid) was produced by the so called "Röst-Process". One decisive feature to control this process was the knowledge of the catalyst behaviour. At that time, BASF (Caro,[2] Knietsch) was the leading company in the field to patent catalyst. These patents strongly influenced the style of physical chemical argumentation and modelling approaches, in contrast to the more common patents in organic chemistry.

With the technical introduction of the Haber-Bosch process before World War I (a "Pull-Factor") and the theoretical understanding of the laws of thermodynamics and the kinetics of heterogeneous systems (a "Push-Factor"), the both parties, industry and academic, were coming together. Certainly also influenced by the multi-discipline genius Wilhelm Ostwald and his "Bridge-Function" (Hapke) capabilities. This congruence was reflected by the increasing number of physical chemical journals[3] (*Zeitschrift für physikalische Chemie* founded 1887, *Zeitschrift für Elektrochemie und angewandte physikalische Chemie* 1894, *Journal of Physical Chemistry*, 1896 etc), and the increasing number of papers as function of time in relation to organic papers.[4] Thus, physical chemistry had crossed the academic boarder. An important mentor and supporter of physical chemistry was Carl Bosch (1878-1940) as opposed to Carl Duisberg (1867-1930), who disliked the mathematical approach of the "modern chemist" preferring a more "holistic approach".[5]

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The most important protagonists of this branch of the sciences (e.g. Haber, Nernst, Polanyi, Loewenstein, Epstein, Nikodem Caro) had to leave Germany and/or were prosecuted during the National Socialist-regime because of their Jewish origin.[6] It was not surprising that some organic NS-chemists declared that physical chemistry was not "clear" ("*anschaulich*", Thiel)[7] enough or was an "intellectual science" (Hansen),[8] like it happened with Heisenberg, Sommerfeld, Bohr, Einstein in physics ("Deutsche Physik"). At this time there were some "dubious papers" (Jost) published in the journal (Z. f. phys. Chem.) which were caused by political pressure (Mentzel[9]), so that the three editors (Bodenstein, Bonhoeffer, Jost) had voluntarily resigned their editorship to protest against this hectoring.[10] One IG-Farben chemist, Heinrich Bütefisch, certainly the most highest ranked NS-member of the IG-Farben board members, defended the merits of the physical chemistry and its success in the German economy e.g. in the synthesis, coal to gasoline. Also the notorious opportunist Peter Adolf Thiessen, recommended the merits of physical chemistry as "decisive to obtain autarchy".[11] This indicates that the physical chemistry was as well established in industry as in the National Socialist political system.

Notes

[1] Carsten Reinhardt, Hans-Werner Schütt, "Christian Friedrich Schönbein und die Frühgeschichte der Katalyseforschung", *Mitteilungen der Fachgruppe Geschichte der Chemie der GDCh* 6 (1991): 18-28.

[2] Carsten Reinhardt, Anthony S. Travis: *Heinrich Caro and the Creation of Modern Chemical Industry*. (Dordrecht: Kluwer Academic Publishers, 2000), 470 pp.

[3] Hans Schmitz, "Zur Entwicklung der chemischen Zeitschriftenliteratur", *Laboratoriumspraxis* 19 (1967): 140-142;
Thomas Hapke, *Die Zeitschrift für physikalische Chemie: 100 Jahre Wechselwirkung zwischen Fachwissenschaft, Kommunikationsmedium und Gesellschaft*, (Herzberg: Bautz, 1990), 23

[4] The *Zeitschrift für physikalische Chemie* was very successful. The number of volumes increased from 1 to 6 in 16 years, the numbers of pages per volume varied between 600-800 pages.

[5] Heinrich Kahlert, *Chemiker unter Hitler – Wirtschaft, Wissenschaft und Technik der deutschen Chemie von 1914-1945*, (Grevenbroich: Bernardus, 2001), 46.

[6] Ute Deichmann, "Chemists and Biochemists During the National Socialist Era" *Angewandte Chemie*, Int. Ed. 41, (2002): 3000-18; Ute Deichmann, "Dem Duce, dem Tenno und unserem Führer ein dreifaches Sieg Heil! Die Deutsche Chemische Gesellschaft und der Verein deutscher Chemiker in der NS-Zeit", in *Zwischen Autonomie und Anpassung. Die Deutsche Physikalische Gesellschaft im Dritten Reich*, ed. Dieter Hoffmann and Mark Walker (Weinheim: Wiley- VCH, 2007), 459-498

[7] A. Thiel, "Zur Frage nach einer 'anschaulichen' Deutung der Osmose und des osmotischen Druckgesetzes" *Z. phys. Chem*. Vol. A178 (1937): 15-17; Steffen Richter, Die "Deutsche Physik"

in: *Naturwissenschaft, Technik und NS-Ideologie* ed. Herbert Mehrtens, Steffen Richter (Frankfurt a.M.: Suhrkamp, 1980), 116-141.

[8] Kahlert, "Chemiker unter Hitler" 45.

Christian Hansen,. *Völkischen Beobachter*, March 19. 1936.

[9] Manfred. Rasch, 'Rudolf Mentzel', in *Neue Deutsche Biographie* (Berlin: Verlag Duncker & Humblot, 1994), 96-98.

[10] Wilhelm Jost, "The first 45 years of physical chemistry in Germany." *Annual Review of Physical Chemistry*, 17 (1966): 1-14;

Max Bodenstein, "50 Jahre Chemische Kinetik". *Zeitschrift für Elektrochemie und angewandte physikalische Chemie*, 47 (1941): 667-672.

[11] Heinrich Bütefisch, "Die Bedeutung der physikalischen Chemie für die chemische Grossindustrie", *Die Chemische Fabrik*, 8 (1935): 227-235; P. A. Thiessen, "Beruf und Stand", *Angewandten Chemie, ,* 28 (1936): 19-20.