An interview with Gerhard Damköhler on the Damköhler number

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I recently invented a machine that allows to talk to people who passed away. To test it I interviewed one of my favorite chemical engineering heroes: Gerhard Damköhler. Unfortunately, shortly after its first use the machine broke down and I was not able to revive it. After several attempts, I gave up on the project. Here is the transcript of the only interview I was able to make.

Daniele Marchisio: "*Herr Doktor Damköhler, können Sie mich gut hören*?"
Gerhard Damköhler: "*Jawohl, wer sind Sie*?"
DM: "*Ich heiße Daniele Marchisio und habe ein paar Fragen für Sie. Sprechen Sie English*?"
GD: "*Ja, ein bisschen*! Let us switch to English!"
DM: "Dr. Damköhler, it is an honor to talk to you. How is the afterlife?"
GD: "*Sehr langweilig, wie sagen Sie das auf English*?"
DM: "Very boring! How come?"
GD: "Here where we are now, we know everything, therefore there is no room for scientific research. Moreover, since the afterlife is a self-governing entity, we have several committees and too many (boring) meetings."
DM: "Sounds very familiar. Listen, we do not have much time and I wanted to know a bit more about your research and the dimensionless number named after you."
GD: "Yes, the Damköhler number. Different formulations exist referring for example to mass transport and chemical reactions in gas-liquid systems or in porous catalysts. It is basically the ratio of two timescales, one is associated with physical transport and flow, while the second one is associated with chemical reactions. The one associated with transport can quantify, *zum Beispiel*, diffusion or convection."
DM: "Right, when and where was this published?"
GD: "In 1936 on the journal "*Zeitschrift für Elektrochemie und angewandte physikalische Chemie*"[1]. I was 28-year-old, back then, and I was conducting the hard life of a young assistant at the *Physikalisch-Chemisches Institut* in Göttingen. It is not nice to see that the life of young researchers is difficult now in Germany and Europe[2] as it was in the past."
DM: "What type of applications did you pursue with this study?"
GD: "I was interested in both catalytic surface reactions and gas-phase reactions. One immediate application of the latter is combustion, which is important in propulsion. This got me into trouble because of the direct relevance to the *Luftwaffe*'s jet engine development program."
DM: "What is the use of this dimensionless number?"

[1] Damköhler, G. (1937), Einflüsse der Strömung, Diffusion und des Wärmeüberganges auf die Leistung von Reaktionsöfen: III. Zur Frage der maximalen Übertemperatur in einem rohrförmigen Kontaktofen bei exothermen Reaktionen. Zeitschrift für Elektrochemie und angewandte physikalische Chemie, 43: 8-13. https://doi.org/10.1002/bbpc.19370430103
[2] Böhm, L. #IchBinHanna [#IchBinHanna] (2021) Chemie-Ingenieur-Technik, 93 (8), pp. 1205-1206. https://doi.org/10.1002/cite.202170810

GD: "As all dimensionless numbers it can be used for asymptotic perturbation analyses, as a similitude parameter for designing chemical reactors, and to identify limiting situations. *Zum Beispiel*, for turbulent reactive systems a Damköhler number tending to zero represents a chemically frozen flow, whereas a Damköhler number tending to infinity identifies a local chemical-equilibrium flow[3]. This is interesting in turbulent non-premixed combustion processes, and in general in chemical reactors in which reactants are fed without being premixed. Mixing occurs while the reactants react, and the two scenarios are very different. When the Damköhler number tends to infinity the chemical reaction is much faster than mixing and the chemical reaction occurs almost instantaneously, based on the local instantaneous composition. Vice versa when the Damköhler number tends to zero the chemical reaction is slower than mixing and it occurs when the reactants are well-mixed."
DM: "*Was bedeutet*… what does well-mixed mean?"
GD: "It depends on the scale of observation, especially in a turbulent flow, where multiple scales are involved. Here the concept of macro-, meso- and micro-mixing, is crucial. It is also important to recognize that in gases, where the Schmidt number is around unity, things are very different from many liquids, where the Schmidt number is larger than unity."
DM: "Enough with dimensionless numbers. Is there anything else you want to say?"
GD: "Life is beautiful and deserves to be lived. My times were very hard. Those were times of ethical dilemmas, which I could not resolve. I did what I did because the situation became unbearable to me, but to the young people I want to say: when experiencing psychological distress seek for help!"
DM: "One last question: you are an incredibly famous scientist, yet your H-index is only equal to three[4]. How does that make you feel?".
GD: "Bibliometrics does not interest me. *Das ist für Erbsenzähler*."

Gerhard Damköhler (16 March 1908 – 30 March 1944) was a German chemist. He had a brief and brilliant career and died too young of suicide. His legacy is celebrated with the Gerhard Damköhler medal[5].

This is dedicated to the memory of all the people in academia who died of suicide and to one in particular who has a special place in my heart.

[3] Marchisio D.L., and Fox R.O. (2016) Reacting Flows and the Interaction between Turbulence and Chemistry. In: Reedijk, J. (Ed.) Elsevier Reference Module in Chemistry, Molecular Sciences and Chemical Engineering. Waltham, MA: Elsevier. 21-Jan-2016. https://doi.org/10.1016/B978-0-12-409547-2.11526-4.
[4] https://www.scopus.com/authid/detail.uri?authorId=16653478200.
[5] https://processnet.org/%C3%9Cber+ProcessNet/Medaillen+und+Preise/Gerhard+Damk%C3%B6hler_Medaille.html.

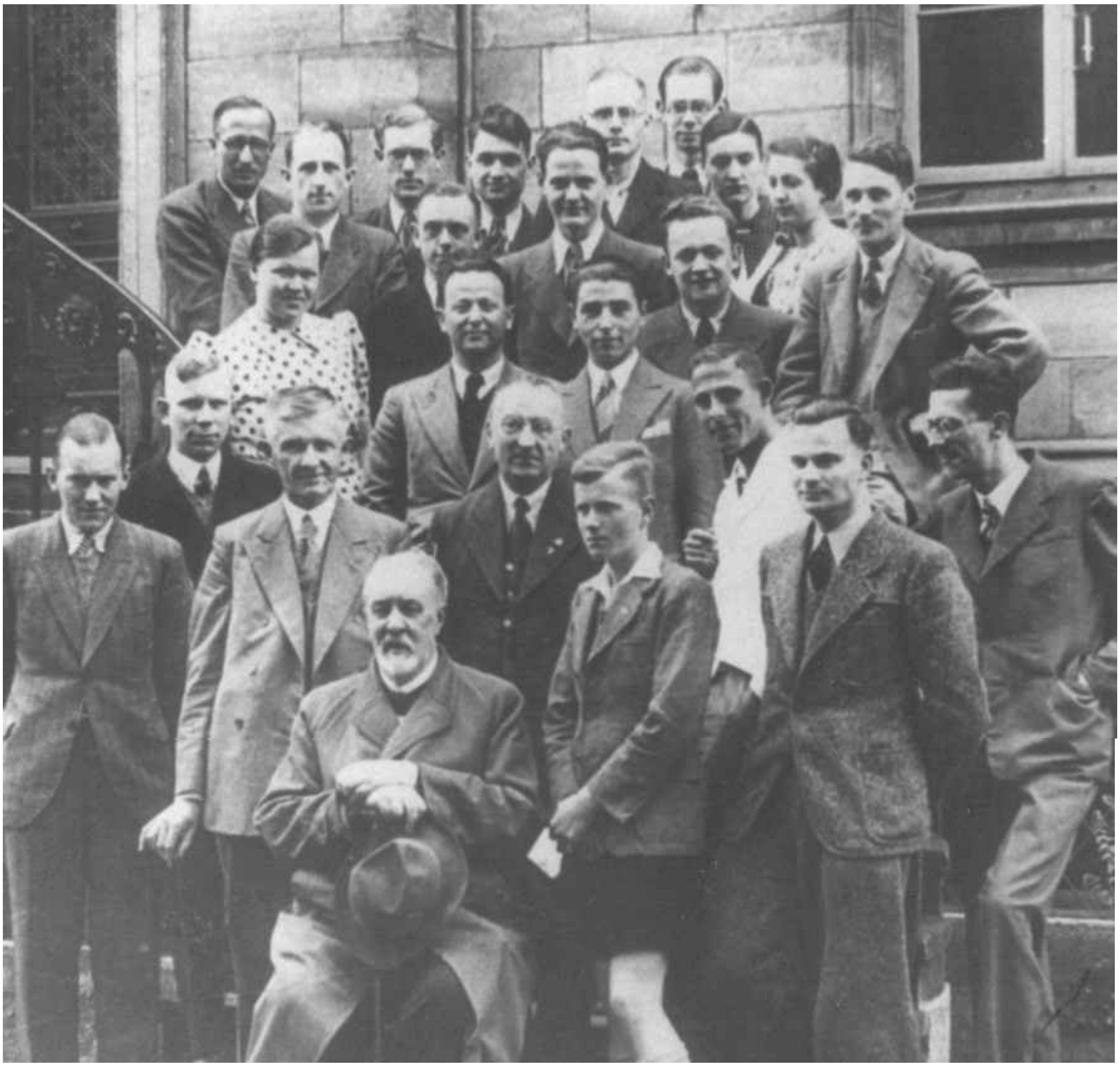
Fig. 1. Göttingen 1 May 1937: Gerhard Damköhler is in the white coat, second row, fourth from the left.