I. Krossing

*The author presented on this page has published more than **25 articles** since 2000 in Angewandte Chemie, most recently:*
"Charge-Scaling Effect in Ionic Liquids from the Charge-Density Analysis of *N*,*N*′-Dimethylimidazolium Methylsulfate": W. Beichel, N. Trapp, C. Hauf, O. Kohler, G. Eickerling, W. Scherer, I. Krossing, *Angew. Chem.* **2014**, *126*, 3207 – 3210; *Angew. Chem. Int. Ed.* **2014**, *53*, 3143 – 3146.

Ingo Krossing

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Position:	Professor of Molecular and Coordination Chemistry, Universität Freiburg
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Education:	1988–1994 Diploma, Ludwig-Maximilians-Universität München (LMU) 1994–1997 PhD supervised by H. Nöth, LMU 1997–1999 Postdoctoral stay with J. Passmore, University of New Brunswick 1999–2002 Habilitation mentored by H. Schnöckel, Universität Karlsruhe
Awards:	**1997** Feodor Lynen Fellowship (Alexander von Humboldt Foundation); **1999–2002** Liebig Fellowship (Fonds der Chemischen Industrie); **2001** ADUC Jahrespreis; **2003–2004** Heisenberg Fellow (DFG; German Research Foundation); **2004** Akademiepreis für Chemie (Göttingen Academy of Sciences and Humanities); **2006** Otto Klung Weberbank Prize; **2012** ERC Advanced Grant
Current research interests:	Research in our group is mainly focused on the synthesis, characterization, application, understanding, prediction, and design of ionic systems (ISs), i.e., compounds and materials that are exclusively formed from usually univalent ions. A main and enabling ingredient of any IS is a weakly coordinating anion (WCA). The ISs under investigation range from very fundamental reactive cations such as elemental clusters and carbocations, to complexes of very weak ligands and further on to more applied systems like ionic liquids (ILs) and electrolytes for batteries or supercapacitors. Current developments are absolute Brønsted acidity and redox scales and the two-dimensional protoelectric potential map
Hobbies:	Mountaineering, ski touring, hiking, mountain biking, traveling, playing the guitar

My favorite saying is … "All roads lead to Rome" (but often not the one you expect to).

My biggest motivation is … to find "terra incognita".

My greatest achievement has been … to recognize that absolute Brønsted acidity and redox scales can be defined in a thermodynamically sound way on the basis of the chemical potential of the proton and the electron. But: without Daniel Himmel, I would have never succeeded.

The most exciting thing about my research is … to work with young and inspiring junior researchers.

I lose track of time when … I read a good book or a good scientific article.

The best advice I have ever been given is … to completely change topics for PhD, postdoctoral, and habilitation work. It broadens your horizons.

If I could go back in time and do any experiment, it would be … the reaction of fluorine and xenon by Jost and Kaye in 1933. I would participate and tell them to expose the mixture to sunlight!

I would have liked to have discovered … the noble gas compounds. Although being of no commercial use, they tremendously influenced our chemical thinking.

When I'm frustrated, I … go mountain biking, mountaineering, or play music. Otherwise I simply talk to my kids and soon forget the stress.

My favorite piece of music … does not exist. I like music as an entity. I always work while listening to music.

The biggest problem that scientists face is … judging what is scientifically really important.

The most important thing I learned from my parents is … endurance, and never giving up.

My favorite place on earth is … Europe. Although having traveled in all the continents, the combination of accessibility, variety, culture, and nature available within Europe is difficult to surpass.

I chose chemistry as a career because … I did not qualify for a biology degree and took what was next on my list.

My best investment was … to raise two marvelous kids.

My secret/not-so-secret passion is … mountaineering in all facets.

If I were not a scientist, I would be … a musician.

What do you think the future holds for your field of research?

Ionic systems promise to deliver further adventures, both in fundamental and applied chemistry. Thus, with the advent of novel WCAs, one can stabilize hitherto unthought-of cations, but also realize the best electrolytes for existing and novel battery systems. You can put every result from this work onto the protoelectric potential map (PPM) and define protoelectric "islands of stability" of interesting substance classes. One prototype are classical and nonclassical carbocations and their position on the PPM. Remember: most carbocations can be described as protonated molecules and the proton is both, an oxidant and a Brønsted acid. But also unusual metal complexes and elemental clusters are awaiting their placement on the PPM. There is lots of work to do!

Has your approach to publishing your results changed since the start of your career?

What really has changed over the years is the amount of work and data we put into the electronic supporting information. This is convenient and we tend to put everything openly in this file, to facilitate both the understanding and reproduction of results. As to the essence of the publications themselves, maybe you get more critical when you get more experienced. However, this is very subjective and I would refrain from taking this expression too seriously.

My 5 top papers:

1. "The Facile Preparation of Weakly Coordinating Anions: Structure and Characterisation of Silverpolyfluoroalkoxyaluminates $Ag[Al(OR^F)_4]$, Calculation of the Alkoxide Ion Affinity": I. Krossing, *Chem. Eur. J.* **2001**, *7*, 490 – 502.
   My first independent paper. Fluorinated alkoxyaluminates $[Al(OR^F)_4]^-$ are WCAs that have made their way from a means to stabilize unusual cationic systems of fundamental interest to a well-developed class of materials that help to prepare inaccessible model compounds as well as being useful in applied research, for example, for ILs, catalysis, polymerization, electrochemistry, and electrolytes. Currently we are aware of at least 50 groups worldwide that use the favorable properties of this WCA class, which is even commercially available (www.iolitec.de).
2. "Why are Ionic Liquids Liquid? A Simple Explanation Based on Lattice and Solvation Energies": I. Krossing, J. M. Slattery, C. Daguenet, P. J. Dyson, A. Oleinikova, H. Weingärtner, *J. Am. Chem. Soc.* **2006**, *128*, 13427 – 13434.
   Our entry into the field of ILs: a suitable Born – Fajans – Haber cycle to understand the phase-change thermodynamics of ILs, and a starting point for many papers that finally led to simple models to predict IL melting points, viscosities, conductivities, and more. These prediction schemes are now included with the IL-Prop module of the commercial COSMOthermX program package.
3. "A Unified pH Scale for All Phases": D. Himmel, S. K. Goll, I. Leito, I. Krossing, *Angew. Chem.* **2010**, *122*, 7037 – 7040; *Angew. Chem. Int. Ed.* **2010**, *49*, 6885 – 6888.
   Our first report on devising absolute scales, now augmented by the redox scale and the two-dimensional variant, the PPM. Hard to overlook the potential. Equally hard to convince people to use it.
4. "$[P_9]^+[Al(OR^F)_4]^-$, the Salt of a Homopolyatomic Phosphorus Cation": T. Köchner, T. A. Engesser, H. Scherer, D. A. Plattner, A. Steffani, I. Krossing, *Angew. Chem.* **2012**, *124*, 6635 – 6637; *Angew. Chem. Int. Ed.* **2012**, *51*, 6529 – 6531.
   Six modifications of elemental phosphorus are known, and hundreds of structures of anionic homoatomic polyphosphides. But it was only in 2012 that we could report the first homopolyatomic phosphorus cation in condensed phases. We were hunting this cation for 13 years, and it was all due to the first two authors (both called Tobias) on the paper that we finally succeeded in settling on this terra incognita.
5. "Crystal Structure Determination of the Nonclassical 2-Norbornyl Cation": F. Scholz, D. Himmel, F. W. Heinemann, P. von R. Schleyer, K. Meyer, I. Krossing, *Science* **2013**, *341*, 62 – 64.
   $AlBr_3$ is an easily accessible extreme Lewis acid. We used this system in combination with HBr or RBr to prepare, crystallize, and fully investigate highly acidic systems such as $[C(CH_3)_3]^+[Al_2Br_7]^-$, $[H(C_6H_6)]^+[Al_2Br_7]^-$, and the title nonsubstituted 2-norbornyl cation $[C_7H_{11}]^+[Al_2Br_7]^-$, thus demonstrating the high acidity of that this superacidic $HBr/AlBr_3$ system and suggesting that it should be used more frequently.

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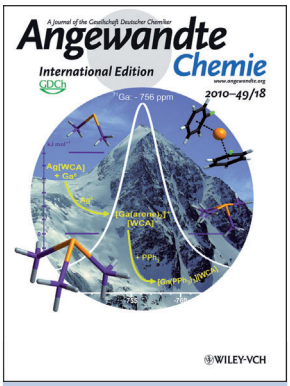

The work of I. Krossing has been featured on the inside cover of Angewandte Chemie:
"A Simple Route to Univalent Gallium Salts of Weakly Coordinating Anions": J. M. Slattery, A. Higelin, T. Bayer, I. Krossing, *Angew. Chem.* **2010**, *122*, 3297 – 3301; *Angew. Chem. Int. Ed.* **2010**, *49*, 3228 – 3231.