Meet Prof. Martin Nielsen, Thieme Chemistry Journals Awardee 2024!

Prof. Martin Nielsen *is Associate Professor in the Department of Chemistry at the Technical University of Denmark (DTU). He obtained both his Master's degree (2007) and his PhD (2009) from Aarhus University in Denmark. After four postdoctoral positions – at Aarhus University (Denmark), Leibniz Institute for Catalysis e.V. (Germany), DTU (Denmark) and Harvard University (USA) – he began his independent career at DTU.*

Thieme: Which field of organic chemistry are you interested in the most and why?

Prof. Nielsen: I am interested in practically any kind of organic chemistry that involves catalysis. It is amazing how one can 'trick' molecules to undergo transformations in ways that they would practically never do on their own. In this regard, I am particularly interested in organometallic catalysis as it is tremendously rich in reactivity compared to the rather static profile that carbon-based chemistry typically resembles. This means that an organometallic catalyst can, for example, reverse the reactivity of an organic functional unit, activate bonds that would otherwise be considered inert (e.g. C–C and C–H bonds), and mediate bond (dis)connections under very mild conditions rather than detrimentally harsh conditions.

Thieme: Following that, what is the focus of your current research activity?

Prof. Nielsen: My current work covers designing new organometallic catalysts and utilizing them for novel organic transformations, ranging from developing new mechanisms to devising industry-relevant processes. I mainly focus on transformations involving manipulating carbon–hydrogen bonds (hydrogenation, dehydrogenation, transfer hydrogenation, hydrogen autotransfer, hydrogenolysis) and their applications in particularly small molecule transformations [*J. Am. Chem. Soc.* **2023**, *145*, 5655; *ACS Catal.* **2023**, *13*, 5449; *Dalton Trans.* **2023**, *52*, 8193] and biomass valorization [*EES Catal.* **2024**, *2*, 803; *ChemSusChem* **2024**, e202301608; *ChemCatChem* **2023**, e202200819; *J. Org. Chem.* **2022**, *87*, 5419; *Green Chem.* **2020**, *22*, 6767].

Thieme: What do you think about the modern role and prospects of organic chemistry?

Prof. Nielsen: Organic chemistry is without doubt a well-studied and mature field. But with the flourishing of relatively new methodologies, such as C–H activation and carbon-centered redox chemistry, I believe that organic chemistry will continue its central role in so many fields. Interestingly, because the C–H bond is ubiquitous and vital, hydrogen-based chemistry has the potential to contribute significantly to many new methodologies within organic chemistry.

Thieme: Which difficulties are there for young upcoming chemists in your field? Do you have any tips?

Prof. Nielsen: Because I wanted to learn more about chemistry before I started my own group, I chose a lengthy postdoc period of 6 years. During my stays in Germany, USA, and Denmark, I learned a lot and I truly believe that it made me a much better chemist. However, a major issue is that many start-up grants provide a maximum PhD age of typically 8 years, which means that I only had a short time to demonstrate my ability to run my own group. Luckily, I still managed to get some funding, but I strongly recommend upcoming chemists with academic ambitions to have some sort of game plan for their first e.g. 5–10 years after their PhD.

Thieme: What is your most important scientific achievement to date and why?

Prof. Nielsen: Within small molecule manipulation, my group's most important scientific achievement is demonstrating that N-heterocyclic carbene (NHC) based ionic liquids can capture and activate CO_2 for organometallic-catalyzed hydrogenation to formic acid under unprecedented mild conditions [*J. Am. Chem. Soc.* **2023**, *145*, 5655]. With this accomplishment we achieved the first example of an additive-free, and hence waste-free, process for both hydrogenating CO_2 to formic acid and dehydrogenating the formic acid back to CO_2 and H_2 under near-ambient conditions.
My group's most important scientific achievement within biomass valorization is that we have developed a system that combines catalytic hydrogenation by an organometallic catalyst with the acid-mediated transformations of biogenic and bio-derived substances [*EES Catal.* **2024**, *2*, 803; *ChemSusChem* **2024**, e202301608]. This allows us to demonstrate not only the first example of employing H_2 and mild conditions for transforming carbohydrate-rich biowaste directly to γ-valerolactone (GVL), but also to include hemicellulose in the substrate pool. The latter is important because hemicellulose accounts for 16–33 wt% of lignocellulosic material (cellulose is 40–50 wt%).

Thieme: Could you tell us something about yourself outside the lab, such as your hobbies or extra-work interests?

Prof. Nielsen: Currently, my one and only hobby outside the lab is my family where my wonderful one-year-old daughter is the star of our story.