Circularity, Steric Attraction and Single-electron Transfer in Main-group Chemistry

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In addition to the well-known Green Chemistry principles that have revolutionized optimizing and sustaining linear processes, Circular Chemistry[1] moves beyond value extension and aims at making chemical processes and production cycles circular by using waste (or ideally products) as resource.

In this lecture, I will highlight the importance of using waste as resource as well as stress the need to develop Circular Technologies, which use chemistry as enabling tool, to target the conservation of critical raw materials (element scarcity) as well as contribute to solving pressing waste problems. Such an endeavor will combine molecular design and synthesis with the environmental fate and impact of current products targeting safe by design (no persistent, bio-accumulative, and toxic compounds; green chemistry) and design for re-use, recovery and recycling (circular chemistry).

Next, I will detail our bottom-up physical (in)organic chemistry approach to develop novel chemical conversions using one-electron processes that aim at using dinitrogen and methane as resource. Our recent findings[2,3] provide important insight for understanding and controlling the generation of highly reactive radical pairs by photoinduced or thermal single-electron transfer, which we are currently applying to the design of new radical ion pairs with photophysical properties tuned for exploiting radical reactivity. We envision such systems could be highly beneficial for designing systems suitable for the activation of inert substrates as well as the development of main-group photo-redox catalysis.

References

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