

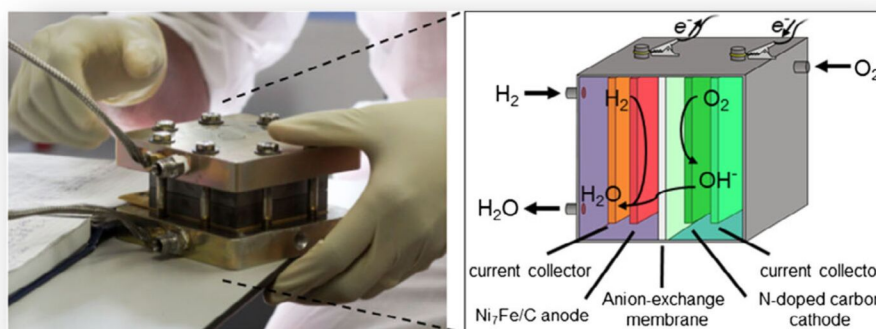
# Sustainable chemistry concepts for closing circular economy loops



Gadi Rothenberg

Van 't Hoff Institute for Molecular Sciences, University of Amsterdam  
g.rothenberg@uva.nl  
<http://hims.uva.nl/hcsc>

The coming decade will be an exciting time for sustainable chemistry. All over the world, people are waking up to the idea that sustainable development is more than just a buzzword, and that society must move towards the long-term goals of CO<sub>2</sub>-neutral processes and a circular economy. Many people talk about this, but we chemists can actually do something about it. In the lecture, I will present the results of four projects that show the impact and possibilities of using green chemistry for closing circular economy loops: a chemical design of simple and cheap materials for fuel-cell electrodes,<sup>[1]</sup> a techno-economic approach converting the ultimate waste into clean electricity,<sup>[2]</sup> a membrane-free flow electrolyser for water splitting,<sup>[3]</sup> and an opportunity for reacting CO<sub>2</sub> with a lower thermodynamic penalty.<sup>[4]</sup>



- [1] An Anion-Exchange Membrane Fuel Cell Containing Only Abundant and Affordable Materials. J. Biemolt, J.C. Douglin, R.K. Singh, E.S. Davydova, N. Yan, G. Rothenberg and D.R. Dekel, *Energy Technol.*, **2021**, 9, 2000909.
- [2] Converting waste toilet paper to electricity: A first-stage techno-economic feasibility study. E. van der Roest, M. van der Spek, A. Ramirez, B. van der Zwaan and G. Rothenberg, *Energy Technol.*, **2017**, 5, 2189.
- [3] A membrane-free flow electrolyzer operating at high current density using earth-abundant catalysts for water splitting. X. Yan, J. Biemolt, K. Zhao, Y. Zhao, X. Cao, X. Wu, Y. Yang, G. Rothenberg and N. Yan, *Nat. Commun.*, **2021**, 12, 4143.
- [4] CO<sub>2</sub> hydrogenation at atmospheric pressure and low temperature using plasma-enhanced catalysis over supported cobalt oxide catalysts. M. Ronda Lloret, Y. Wang, P. Oulego, G. Rothenberg, X. Tu and N.R. Shiju, *ACS Sust. Chem. Eng.*, **2020**, 8, 47, 17397.

**Gadi Rothenberg** is Professor and Chair of Heterogeneous Catalysis and Sustainable Chemistry at the University of Amsterdam. He teaches courses on catalysis and workshops on scientific writing and innovation. Rothenberg has published three books and 224 peer-reviewed papers, invented 16 patents and co-founded four companies. His current research interests include clean energy, electrocatalysis, and creating value from waste. Since 2020 he is also the Technical Director CO<sub>2</sub> and Circular Economy at the Shanghai Institute for CleanTech Innovation.



<https://www.youtube.com/watch?v=fhLiAf2Ln8E&t=2s>