

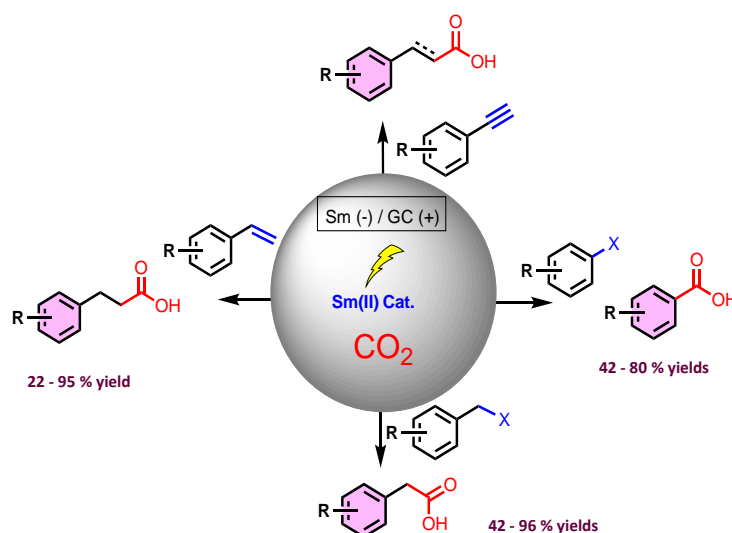
“Use of electrochemistry to create efficient SmI₂-mediated catalytic systems, the famous "Kagan reagent"”

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Abstract

The development of sustainable and selective samarium-based catalytic systems remains a long-standing challenge in organic synthesis. Over the past decade, we have developed a Sm(II)-electrocatalytic strategy that enables the precise and tunable reduction of various functional groups, including carbonyls,¹ imines,² and nitro groups.³ This strategy also addresses the reduction of CO₂, utilizing it as a C1-building block in organic chemistry to access valuable organic compounds.⁴ All these transformations were performed under mild and operationally simple electrochemical conditions. By controlling the electrolytic environment, complete selectivity toward the desired compounds is achieved. The method displays a broad substrate scope, excellent chemoselectivity, and high functional-group tolerance. Its synthetic potential is exemplified by the gram-scale synthesis of various drugs, such as naproxen and indobufen,⁵ a clinically relevant antiplatelet drug. Mechanistic investigations, including the isolation of key intermediates, deuterium-labeling studies, and electrochemical measurements, support a stepwise reductive pathway. This work establishes a versatile, green, and scalable Sm(II)-electrocatalytic platform for the controlled reduction of numerous compounds.



Recent Publications (maximum 5)

1. L. Sun, K. Sahloul, M. Mellah, *ACS Catalysis* **2013**, 2568.
2. Y.-F. Zhang, M. Mellah, *ACS catalysis*, **2017**, *12*, 8480.
3. Y.-F. Zhang, E. Schulz, M. Mellah, *ChemCatChem*, **2024**, *16*, e202400303
4. S. Bazzi, E. Schulz, M. Mellah, *Org. Lett.*, **2019**, *21*, 10033.
5. S. Bazzi, L. Hu, E. Schulz, M. Mellah, *Organometallics*, **2023**, *12*, 1425–1431.

Biography



Prof. Mohamed Mellah obtained his Ph.D. in 2001 from Université Paris-Est Creteil under the supervision of Prof. Jacques Périchon, specializing in electrochemical organic synthesis. He then completed a postdoctoral position at CNRS & EDF focused on the development of electrosynthetic processes, followed by an academic postdoctoral fellowship at Université Rennes 1. In 2003, he joined Université Paris-Saclay (Orsay) in the group of Prof. Emmanuelle Schulz, where he now holds a senior academic position. His research is centered on the development of sustainable catalytic methodologies, with a particular emphasis on electrochemistry as a green alternative to conventional redox reagents. Prof. Mellah has made significant contributions to asymmetric catalysis, notably through the design of chiral salen-based polymeric materials for heterogeneous catalysis, as well as the development of samarium-based electrocatalytic systems enabling highly chemoselective reductions.

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