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Editorial

Catalytic Oxidation of Hydrocarbons

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The catalytic oxidation of hydrocarbons stands at the forefront of sustainable chemical transformations, offering pathways to selectively convert aliphatic and aromatic compounds into valuable oxygenated products. This Special Issue highlights the latest developments and innovations in the field, featuring a diverse array of research papers that explore several aspects of hydrocarbon oxidation.

One example is the first contribution, which delves into hydrocarbon oxidation depth using the $H_2O_2/Cu_2Cl_4{\cdot}2DMG/CH_3CN$ system (contribution 1). This study not only elucidate the catalytic mechanism but also provides insights into the efficiency of the oxidation process.

The utilization of commercial gold complexes supported on functionalized carbon materials plays a pivotal role in the direct oxidation of ethane into acetic acid (contribution 2). This research showcases the potential of gold-based catalysts in the selective transformation of alkanes into high-value-added chemicals.

The intriguing role of PhOH and tyrosine in the selective oxidation of hydrocarbons adds a new dimension to our understanding of the factors influencing catalytic selectivity (contribution 3). This study offers valuable insights into the details of controlling the oxidation process for optimal product yields.

Moving beyond simple hydrocarbons, an investigation into the one-stage catalytic oxidation of adamantane to tri-, tetra-, and penta-ols broadens the scope of catalytic oxidation methodologies (contribution 4). The results presented in this paper open up avenues for the controlled synthesis of complex oxygenated compounds from hydrocarbons.

Studies of nickel/samarium-doped ceria provide essential information for the catalytic partial oxidation of methane, exploring the role of oxygen vacancy in enhancing catalytic performance (contribution 5). Similarly, the enhanced performance of OMS-2-supported CuO_x catalysts for the oxidation of carbon monoxide, ethyl acetate, and toluene underscores the versatility of these catalysts (contribution 6).

The selective catalytic oxidation of toluene into benzaldehyde is investigated with a focus on the effect of aging time and calcination temperature using Cu_xZn_yO mixed metal oxide nanoparticles (contribution 7). This work contributes valuable insights into the optimization of catalysts for specific oxidation reactions.

Further contributions examine the oxidation of 5-hydroxymethylfurfural on supported Ag, Au, Pd, and bimetallic Pd–Au catalysts, exploring the impact of the support on catalytic activity (contribution 8). Additionally, a comprehensive study on the reaction mechanism for methane-to-methanol in Cu-SSZ-13, employing first-principles analysis of the $Z_2[Cu_2O]$ and $Z_2[Cu_2OH]$ motifs, expands our understanding of methane oxidation (contribution 9).

The application of artificial neural network modeling to increase the efficiency of optimized V-SBA-15 catalysts in the selective oxidation of methane into formaldehyde showcases the integration of advanced computational methods in catalyst design (contribution 10).

This Special Issue also introduces newly isolated alkane hydroxylase and lipase-producing *Geobacillus* and *Anoxybacillus* species involved in crude oil degradation (contribution 11). This contributes a biotechnological perspective to the catalytic oxidation of hydrocarbons, emphasizing the potential of microorganisms in environmental remediation.

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Citation: Carabineiro, S.A.C. Catalytic Oxidation of Hydrocarbons. *Catalysts* **2024**, *14*, 111. https://doi.org/10.3390/catal14020111

Received: 20 January 2024
Accepted: 28 January 2024
Published: 31 January 2024

As we navigate the complexities of hydrocarbon oxidation, this collection of research papers not only presents the current state of the field but also paves the way for future advancements.

As Guest Editor for this Special Issue, I express my gratitude to all the contributing authors and also to the dedicated staff members at MDPI for their important editorial support. We look forward to the continued exploration of catalytic processes that drive the sustainable transformation of hydrocarbons.

Funding: SACC is grateful to Fundação para a Ciência e a Tecnologia (FCT), Portugal for Scientific Employment Stimulus-Institutional Call (DOI 10.54499/CEECINST/00102/2018/CP1567/CT0026) and to the Associate Laboratory for Green Chemistry-LAQV financed by national funds from FCT/MCTES (UIDB/50006/2020 and UIDP/5006/2020).

Data Availability Statement: Not applicable.

Conflicts of Interest: The author declares no conflicts of interest.

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