

Dual-site catalysts featuring platinum-group-metal atoms on copper shapes boost hydrocarbon formations in electrocatalytic CO₂ reduction

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Copper-based catalyst is uniquely positioned to catalyze the hydrocarbon formations through electrochemical CO₂ reduction. The catalyst design freedom is limited for alloying copper with H-affinitive elements represented by platinum group metals because the latter would easily drive the hydrogen evolution reaction to override CO₂ reduction. We report an adept design of anchoring atomically dispersed platinum group metal species on both polycrystalline and shape-controlled Cu catalysts, which now promote targeted CO₂ reduction reaction while frustrating the undesired hydrogen evolution reaction. Notably, alloys with similar metal formulations but comprising small platinum or palladium clusters would fail this objective. With an appreciable amount of CO-Pd₁ moieties on copper surfaces, facile CO' hydrogenation to CHO' or CO-CHO' coupling is now viable as one of the main pathways on Cu(111) or Cu(100) to selectively produce CH₄ or C₂H₄ through Pd-Cu dual-site pathways. The work broadens copper alloying choices for CO₂ reduction in aqueous phases.

Among the catalytic reactions that can hydrogenate CO₂ into energy-intensive hydrocarbon molecules (HCs), the electrocatalytic CO₂ reduction reaction (CO₂RR) featuring CO₂ hydrogenation without producing H₂ gas in any prior steps is of particular interest. While there are ample choices of elements to catalyze CO₂RR into CO and formate molecules¹, copper (Cu) is the demonstrated element that can effectively catalyze the HCs formation (especially C₂-) owing to its optimal binding energies for both hydrogen (ΔE_{H^*}) and carbonyl species (ΔE_{CO})^{2–4}, the ubiquitous intermediate during CO₂RR. Copper, therefore, serves as a unique catalytic metal to not only enable the circular

carbon economy on earth but to extend human life beyond earth's orbit through in situ utilization of the in-space CO₂ to make methane as fuel or ethylene as building block molecules.

Metal alloying is a broadly employed strategy to accelerate the CO₂RR while reasonably suppressing the competitive hydrogen evolution reaction (HER)^{5–7}. Metals such as Ag, Au, Pb, and Sn that are either in the same group or to the right of Cu in the periodic table have been extensively studied⁸. These metals, with a typical positive H' binding energy (>0.5 eV), are the well-accepted desired alloying choices with copper due to their unfavorable energetics toward the

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Catalytic Formations

Michael J. Krische



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Catalytic Formations Ali Rahim, 2006 At the dawn of the twenty first century digital technologies have enabled new techniques for the development of architecture In Catalytic Formations Ali Rahim suggests that these digital design techniques have the potential to affect the wider cultural landscape in profound ways Digital technologies allow architecture to engage in a feedback loop with its context to absorb influences and produce concrete effects on its users This book offers both a philosophy and specific techniques for how architects can catalyze cultural advancements Also included are provocative examples from Rahim s work at Contemporary Architecture Practice and projects by Zaha Hadid Greg Lynn FORM and other cutting edge architects

Metal Catalyzed Reductive C-C Bond Formation Michael J. Krische, 2007-07-20 The prototypical catalytic reductive C-C bond formations the Fischer-Tropsch reaction 1 and alkene hydroformylation 2 were discovered in 1922 and 1938 respectively 3 4 These processes which involve reductive coupling to carbon monoxide have long been applied to the industrial manufacture of commodity chemicals 5 Notably alkene hydroformylation also known as the oxo synthesis has emerged as the largest volume application of homogeneous metal catalysis accounting for the production of over 7 million metric tons of aldehyde annually Despite the impact of these prototypical reductive C-C bond formations this field of research lay fallow for several decades Eventually the increased availability of mild terminal reductants in particular silanes led to a renaissance in the area of catalytic reductive C-C bond formation For example the first catalytic reductive C-C couplings beyond hydroformylation which involve the hydrosilylative dimerization of conjugated dienes 6 12 appeared in 1969 approximately 16 years after the first reported metal catalyzed alkene hydrosilylation 13 Following these seminal studies the field of catalytic reductive C-C bond formation underwent explosive growth culminating in the emergence of an evergrowing body of research encompassing a powerful set of transformations To our knowledge no thematic volumes devoted solely to metal catalyzed reductive C-C bond formation have been assembled For the first time in this issue of Topics in Current Chemistry we present a compilation of monographs from several leaders in this burgeoning area of research This collection of reviews serves to capture the diversity of catalytic reductive C-C couplings presently available and in turn the remarkable range of reactivity embodied by such transformations There is no indication that this field has reached its zenith and it is the hope of the present author that this volume will fuel further progress

Reservoir Formation Conditions and Enrichment Mechanisms of Shale Oil and Gas Kun Zhang, Shu Jiang, Jijun Li, Dadong Liu, Jingqiang Tan, 2023-05-15

Material Design Thomas Schröpfer, 2012-12-13 The approach of Informing Architecture by Materiality opens the way to an innovative use of materials in the design professions Taking material qualities and properties such as texture elasticity transparency and fluidity as a point of departure the concept described and employed here transcends the conventional definitions of building materials Instead the focus is on a multitude of material operations like folding and bending carving and cutting weaving and knitting mirroring and screening The featured design strategies and methods

address established and new materials alike They are applied both to the scale of the detail and the entire building The examples comprise prototype structures as well as large building projects Eight chapters deal with surfaces and layers joints and junctions weaving and texturing nanoscale transformations responsiveness the integration of ephemeral factors like wind and light as well as material collections providing professional resources Written by renowned experts in this field the book features many examples from international contemporary architecture The introductory part provides the conceptual background while a final chapter describes consequences for pressing issues of today like sustainability or life cycle assessment

Acid Catalysis in Lactone Formation ... Harold Wilberforce Close,1925 **New and Future Developments in Catalysis** Steven L Suib,2013-07-11 New and Future Developments in Catalysis is a package of books that compile the latest ideas concerning alternate and renewable energy sources and the role that catalysis plays in converting new renewable feedstock into biofuels and biochemicals Both homogeneous and heterogeneous catalysts and catalytic processes will be discussed in a unified and comprehensive approach There will be extensive cross referencing within all volumes This volume presents a complete picture of all carbon dioxide CO₂ sources outlines the environmental concerns regarding CO₂ and critically reviews all current CO₂ activation processes Furthermore the volume discusses all future developments and gives a critical economic analysis of the various processes Offers in depth coverage of all catalytic topics of current interest and outlines future challenges and research areas A clear and visual description of all parameters and conditions enabling the reader to draw conclusions for a particular case Outlines the catalytic processes applicable to energy generation and design of green processes

Arene Chemistry Jacques Mortier,2015-12-14 Organized to enable students and synthetic chemists to understand and expand on aromatic reactions covered in foundation courses the book offers a thorough and accessible mechanistic explanation of aromatic reactions involving arene compounds Surveys methods used for preparing arene compounds and their transformations Connects reactivity and methodology with mechanism Helps readers apply aromatic reactions in a practical context by designing syntheses Provides essential information about techniques used to determine reaction mechanisms

American Medicine ,1904 **The Chemistry & Physics of Clays and Other Ceramic Materials** Alfred Broadhead Searle,1924 *A Dictionary of Applied Chemistry* Thomas Edward Thorpe,1921 **Industrial Chemist and Chemical Manufacturer** ,1926 **Reprint and Circular Series of the National Research Council** ,1921 **Reprint and Circular Series of the National Research Council** National Research Council (U.S.),1919 *American Dyestuff Reporter* ,1923 Includes proceedings of American Association of Textile Chemists and Colorists

Transactions Faraday Society,1928 **British Chemical Abstracts** ,1926 Soap Gazette and Perfumer ,1913 The Journal of Physical Chemistry ,1917 *Journal of Physical & Colloid Chemistry* ,1926 Includes section New Books **Industrial Arts Index** ,1922

The Top Books of the Year Catalytic Formations The year 2023 has witnessed a remarkable surge in literary brilliance, with numerous engrossing novels enthralling the hearts of readers worldwide. Lets delve into the realm of popular books, exploring the engaging narratives that have enthralled audiences this year. The Must-Read : Colleen Hoover's "It Ends with Us" This poignant tale of love, loss, and resilience has gripped readers with its raw and emotional exploration of domestic abuse. Hoover skillfully weaves a story of hope and healing, reminding us that even in the darkest of times, the human spirit can succeed. Uncover the Best : Taylor Jenkins Reids "The Seven Husbands of Evelyn Hugo" This captivating historical fiction novel unravels the life of Evelyn Hugo, a Hollywood icon who defies expectations and societal norms to pursue her dreams. Reids compelling storytelling and compelling characters transport readers to a bygone era, immersing them in a world of glamour, ambition, and self-discovery. Discover the Magic : Delia Owens "Where the Crawdads Sing" This evocative coming-of-age story follows Kya Clark, a young woman who grows up alone in the marshes of North Carolina. Owens crafts a tale of resilience, survival, and the transformative power of nature, captivating readers with its evocative prose and mesmerizing setting. These bestselling novels represent just a fraction of the literary treasures that have emerged in 2023. Whether you seek tales of romance, adventure, or personal growth, the world of literature offers an abundance of engaging stories waiting to be discovered. The novel begins with Richard Papen, a bright but troubled young man, arriving at Hampden College. Richard is immediately drawn to the group of students who call themselves the Classics Club. The club is led by Henry Winter, a brilliant and charismatic young man. Henry is obsessed with Greek mythology and philosophy, and he quickly draws Richard into his world. The other members of the Classics Club are equally as fascinating. Bunny Corcoran is a wealthy and spoiled young man who is always looking for a good time. Charles Tavis is a quiet and reserved young man who is deeply in love with Henry. Camilla Macaulay is a beautiful and intelligent young woman who is drawn to the power and danger of the Classics Club. The students are all deeply in love with Morrow, and they are willing to do anything to please him. Morrow is a complex and mysterious figure, and he seems to be manipulating the students for his own purposes. As the students become more involved with Morrow, they begin to commit increasingly dangerous acts. The Secret History is a masterful and suspenseful novel that will keep you speculating until the very end. The novel is a cautionary tale about the dangers of obsession and the power of evil.

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