



# Fundamental Issues in Control of Carbon Gasification Reactivity

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# Fundamental Issues In Control Of Carbon Gasification Reactivity

**Huangqi Zhang**



## **Fundamental Issues In Control Of Carbon Gasification Reactivity:**

**Fundamental Issues in Control of Carbon Gasification Reactivity** L Lahaye, Pierre Ehrburger, 2012-12-06 During the last decade there has been a renewed interest in understanding from a fundamental point of view the gasification of carbon. Basically there are two major issues in controlling the reactivity of carbon: i) reduction of the gasification rate of carbon materials in hostile environment ii) increase of the gasification rate in order to utilize carbonaceous compounds more effectively. Although these two objectives look somewhat contradictory they are part of the general topics of understanding gasification reactivity of carbon. Refractory applications of carbon in furnace linings, seals and vanes as well as the use of carbon-carbon or carbon-ceramic composites in structures able to withstand corrosion at high temperature require a better understanding of the fundamentals involved in carbon oxidizing gas reactions:  $2C + O_2 \rightarrow 2CO$ ,  $C + H_2O \rightarrow CO + H_2$ . Furthermore a great interest of aluminium producers is extending the lifetime of carbon electrodes in alumina electrolysis which primarily depends on reducing their consumption rates by air or carbon dioxide. Proper control of gasification reactions is also of prime importance in manufacturing carbonaceous adsorbents like granular activated carbon, clothes of high adsorption characteristics. The balance between increase of porosity and decrease in mechanical strength during activation is critical for developing new porous types of carbon materials in particular for carbon clothes and this can only be achieved by a careful control of the gasification reaction.

**Synthesis Gas** James G. Speight, 2020-06-10 As a follow up to the Handbook of Gasification Technology also from Wiley Scrivener Synthesis Gas goes into more depth on how the products from this important technology can reduce our global carbon footprint and lead the United States and other countries toward energy independence. The environmental benefits are very high and along with carbon capture and renewable fuels synthesis gas or syngas is a huge step toward environmental sustainability. Synthesis gas is one of the most important advancements that has ever occurred in energy production. Using this technology for example coal, biomass, waste products or a combination of two or more of these can be gasified into a product that has roughly half the carbon footprint of coal alone. Used on a massive scale just think of the potential for reducing carbon emissions. Synthesis Gas covers all aspects of the technology from the chemistry processes and production to the products, feedstocks and even safety in the plant. Whether a veteran engineer or scientist using it as a reference or a professor using it as a textbook this outstanding new volume is a must have for any library.

**Gasification of Unconventional Feedstocks** James G. Speight, 2014-01-03 World gasification capacity is expected to grow by more than 70% by 2015. While gasification is not a new process the higher price in crude has lead operators and refineries to look at all possible coal based technologies for energy conversion and with the flow of heavy oil, tar sands and other unconventional feedstocks making their way to the refineries for processing refinery managers and engineers alike must be made aware of how to process these uncommon energy sources. Gasification of Unconventional Feedstocks addresses these unfamiliar feeds and provides a quick and up to date reference on the background process technology and

downstream applications required to help refineries maximize profits turning low value feedstock to beneficial syngas and other fuel products Clear and comprehensive Gasification of Unconventional Feedstocks provides engineers and refinery managers with the tools needed to quickly adapt to the more unconventional feedstocks and still maximize their refineries potential Get up to speed on how to adjust your refinery s processing to unconventional feedstocks Understand the technology necessary to safely and effectively manage unfamiliar feeds Turn low value product to profit quickly with must have tips and rules of thumb *Handbook of Gasification Technology* James G. Speight, 2020-04-14 Gasification is one of the most important advancements that has ever occurred in energy production Using this technology for example coal can be gasified into a product that has roughly half the carbon footprint of coal On a large scale gasification could be considered a revolutionary development not only prolonging the life of carbon based fuels but making them greener and cleaner As long as much of the world still depends on fossil fuels gasification will be an environmentally friendlier choice for energy production But gasification is not just used for fossil fuels Waste products that would normally be dumped into landfills or otherwise disposed of can be converted into energy through the process of gasification The same is true of biofeedstocks and other types of feedstocks thus making another argument for the widespread use of gasification The Handbook of Gasification Technology covers all aspects of the gasification in a one stop shop from the basic science of gasification and why it is needed to the energy sources processes chemicals materials and machinery used in the technology Whether a veteran engineer or scientist using it as a reference or a professor using it as a textbook this outstanding new volume is a must have for any library Chemistry & Physics of Carbon Peter A. Thrower, 2023-05-31 This 24th volume continues in the tradition of its predecessors presenting authoritative interdisciplinary coverage of contemporary topics in the field of carbon chemistry and physics With contributions by leading international experts this volume describes pitch polymerization kinetics during mesophase formation and the constitution of coexisting phases in mesophase pitch during heat treatment elucidates the mechanism of mesophase formation and pitch polymerization kinetics after mesophase formation examines the importance of physical solid state electro and analytical chemistry in the study of carbon surfaces discusses the theoretical background for the thermal conductivity of diamonds single crystal diamonds and chemically vapour deposited diamond films and explains the chemistry involved in the commercial fabrication and use of needle coke **Hydrogen Production Processes in Refining Technology** James G. Speight, 2024-06-26 This book details the various approaches to the production of hydrogen in petroleum refining The need for hydrogen is addressed and then the differences between the processes are detailed This practical and accessible guide is written for managers professionals and technicians as well as graduate students transitioning into the refining industry Key Features Describes hydrogen purification methods and processes providing relevant process data and fully describing process operations Describes hydrogen purification methods and processes detailing the types of feedstock that can be used and exploring the options and parameters of each process Details

commercial processes including gasification pretreatment and reactions and considers next generation processes and developments

**Carbon Materials for Catalysis** Philippe Serp, José Luis Figueiredo, 2009-02-04 This is the first comprehensive book covering all aspects of the use of carbonaceous materials in heterogeneous catalysis It covers the preparation and characterization of carbon supports and carbon supported catalysts carbon surface chemistry in catalysis the description of catalytic photo catalytic or electro catalytic reactions including the development of new carbon materials such as carbon xerogels aerogels or carbon nanotubes and new carbon based materials in catalytic or adsorption processes This is a premier reference for carbon inorganic and physical chemists materials scientists and engineers chemical engineers and others

*Biomass combustion science, technology and engineering* Y. Neubauer, 2013-04-04 The gasification of biomass promises plentiful options for efficient feedstock utilization Often the main goal is the provision of energy in the form of heat or power or cooling by burning the combustible gases Another goal of biomass gasification is the generation of synthesis gases for further catalytic synthesis into base chemicals or storable energy carriers such as liquid fuels methanol mixed alcohols Fischer Tropsch liquids and dimethyl ether or gaseous fuels such as substitute natural gas SNG or hydrogen This chapter describes the fundamentals of gasification technological developments and future trends for different sizes of plants and gives an overview of the process chains incorporating biomass gasification

Handbook of Industrial Hydrocarbon Processes James G. Speight, 2010-12-24 Written by an author with over 38 years of experience in the chemical and petrochemical process industry this handbook will present an analysis of the process steps used to produce industrial hydrocarbons from various raw materials It is the first book to offer a thorough analysis of external factors effecting production such as cost availability and environmental legislation An A Z list of raw materials and their properties are presented along with a commentary regarding their cost and availability Specific processing operations described in the book include distillation thermal cracking and coking catalytic methods hydroprocesses thermal and catalytic reforming isomerization alkylation processes polymerization processes solvent processes water removal fractionation and acid gas removal Flow diagrams and descriptions of more than 250 leading edge process technologies An analysis of chemical reactions and process steps that are required to produce chemicals from various raw materials Properties availability and environmental impact of various raw materials used in hydrocarbon processing

*Biomass Combustion Science, Technology and Engineering* Lasse Rosendahl, 2013-04-04 The utilisation of biomass is increasingly important for low or zero carbon power generation Developments in conventional power plant fuel flexibility allow for both direct biomass combustion and co firing with fossil fuels while the integration of advanced technologies facilitates conversion of a wide range of biomass feedstocks into more readily combustible fuel Biomass combustion science technology and engineering reviews the science and technology of biomass combustion conversion and utilisation Part one provides an introduction to biomass supply chains and feedstocks and outlines the principles of biomass combustion for power generation Chapters also describe the

categorisation and preparation of biomass feedstocks for combustion and gasification Part two goes on to explore biomass combustion and co firing including direct combustion of biomass biomass co firing and gasification fast pyrolysis of biomass for the production of liquids and intermediate pyrolysis technologies Largescale biomass combustion and biorefineries are then the focus of part three Following an overview of large scale biomass combustion plants key engineering issues and plant operation are discussed before the book concludes with a chapter looking at the role of biorefineries in increasing the value of the end products of biomass conversion With its distinguished editor and international team of expert contributors Biomass combustion science technology and engineering provides a clear overview of this important area for all power plant operators industrial engineers biomass researchers process chemists and academics working in this field Reviews the science and technology of biomass combustion conversion and utilisation Provides an introduction to biomass supply chains and feedstocks and outlines the principles of biomass combustion for power generation Describes the categorisation and preparation of biomass feedstocks for combustion and gasification

Coal-Fired Power Generation Handbook James G. Speight, 2021-02-17 Rund ein Viertel des weltweiten Energieverbrauchs wird mit Kohle bestritten und von der weltweit geforderten Kohle werden ca 65 % an Stromerzeuger und 33 % an industrielle Abnehmer geliefert wobei der Rest berwiegend an Verbraucher im privaten und gewerblichen Bereich geht Es wird erwartet dass der Anteil der Kohle am gesamten Energieverbrauch weltweit bis 2035 auf knapp 30 % steigt Dieses Werk beschreibt die Herausforderungen und die einzelnen Schritte bei der Energieproduktion aus Kohle und befasst sich mit den Herausforderungen beim Umgang mit Umweltschutzbedenken gegen die Nutzung von Kohle in den Kraftwerken der Zukunft Es werden neue Technologien beschrieben mit denen die Freisetzung von sch dlichen Schwefel Stickstoff und Quecksilberpartikeln bei der Verbrennung von Kohle zur Stromerzeugung nahezu eliminiert werden kann Au erdem wird beschrieben mit welchen Technologien sich die von den Kohlekraftwerken ausgesto enen Treibhausgase abscheiden lassen und wie es m glich ist zu verhindern dass diese Emissionen zur globalen Erw rmung beitragen Das Buch ist von einem der weltweit f hrenden Energieexperten verfasst und ist ein absolutes Muss f r alle Ingenieure Wissenschaftler und Studierenden in diesem Fachbereich denn es dient als wertvolles Nachschlagewerk und Leitfaden in einem sich rasch ver ndernden Umfeld

The Chemistry and Technology of Coal, Second Edition, James G. Speight, 1994-07-07 Thoroughly rewritten and updated to reflect the latest advances in technology and highlighting the environmental aspects now being emphasized within the coal industry this Second Edition of a highly acclaimed reference text provides a comprehensive overview of coal science covering topics ranging from the origins of coal to mining and contemporary uses Maintaining and enhancing the clarity of presentation that made the first edition so popular The Chemistry and Technology of Coal Second Edition Considers the implications of the Clean Air Act Examines the effects of combustion products on the atmosphere Details practical elements of coal evaluation procedures Clarifies misconceptions concerning the organic structure of coal Discusses the physical thermal electrical and mechanical properties

of coal Analyzes the development and current status of combustion and gasification techniques      **Nanocarbon-Inorganic Hybrids** Dominik Eder,Robert Schlögl,2014-08-20 Nanocarbon Inorganic Hybrids is dedicated exclusively to the new family of functional materials covering a multidisciplinary research field that combines materials science chemistry and physics with nanotechnology and applied energy science It provides a concise introduction into fundamental principles of nanocarbons defines hybrids and composites explains the physics behind sustainability and illustrates requirements for successful implementation in energy applications It further reviews the current research on developing concepts for designing nanocarbon hybrids unravels mechanistic details of interfacial electron transfer processes and highlights future challenges and perspectives associated with exploiting these exciting new materials in commercial energy applications and beyond This comprehensively written book is indispensable for Master and PhD students seeking to become familiar with a modern field of knowledge driven material science as well as for senior researchers and industrial staff scientists who explore the frontiers of knowledge      Gasification for Synthetic Fuel Production R Luque,J Speight,2014-08-29 Gasification involves the

conversion of carbon sources without combustion to syngas which can be used as a fuel itself or further processed to synthetic fuels The technology provides a potentially more efficient means of energy generation than direct combustion This book provides an overview of gasification science and engineering and the production of synthetic fuels by gasification from a variety of feedstocks Part one introduces gasification reviewing the scientific basis of the process and gasification engineering Part two then addresses gasification and synthetic fuel production processes Finally chapters in part three outline the different applications of gasification with chapters on the conversion of different types of feedstock Examines the design of gasifiers the preparation of feedstocks and the economic environmental and policy issues related to gasification Reviews gasification processes for liquid fuel production Outlines the different applications of gasification technology

*Developments in Thermochemical Biomass Conversion* A.V. Bridgwater,D.G.B. Boocock,2013-11-21 There have been many developments in the science and technology of thermo chemical biomass conversion since the previous conference on Advances in Thermochemical Biomass Conversion in Interlaken Switzerland in 1992 This fourth conference again covers all aspects of thermal biomass conversion systems from fundamental research through applied research and development to demonstration and commercial applications to reflect the progress made in the last four years All aspects of bioenergy systems are covered from pretreatment through to end user applications with increased consideration paid to the environmental benefits and problems of implementing bio energy systems There was an excellent response with over 200 papers offered and over 180 delegates from 29 countries attending the conference The programme was divided into five main areas covering pyrolysis pretreatment gasification combustion and system studies and this division is reflected in the structure of these conference proceedings Each main section was preceded by a state of the art review to provide a focus for the ensuing presentations and an authoritative reference All the papers included have been subject to a full peer review

process As with any international conference an important aim was to exchange ideas and discuss problems with fellow researchers as well as to hear about the latest research and development and applications A workshop programme was included to encourage this interaction in areas of interest selected by participants The resultant workshop reports provide a summary of topical problems and opportunities

**Natural Gas** James G. Speight, 2018-11-26 Natural Gas A Basic Handbook Second Edition provides the reader with a quick and accessible introduction to a fuel source industry that is transforming the energy sector Written at an introductory level but still appropriate for engineers and other technical readers this book provides an overview of natural gas as a fuel source including its origins properties and composition Discussions include the production of natural gas from traditional and unconventional sources the downstream aspects of the natural gas industry including processing storage and transportation and environmental issues and emission controls strategies This book presents an ideal resource on the topic for engineers new to natural gas for advisors and consultants in the natural gas industry and for technical readers interested in learning more about this clean burning fuel source and how it is shaping the energy industry Updated to include newer sources like shale gas Includes new discussions on natural gas hydrates and flow assurance Covers environmental issues Contain expanded coverage of liquefied natural gas LNG

Innovative Exploration Methods for Minerals, Oil, Gas, and Groundwater for Sustainable Development A. K. Moitra, Jayanta Bhattacharya, J. R. Kayal, Biplab Mukerji, A.K. Das, 2021-12-03 Innovative Exploration Methods for Mineral Oil Gas and Groundwater for Sustainable Development provides an integrated approach to exploration encompassing geology geophysics mining and mineral processing In addition groundwater exploration is included as it is central to the development of earth resources As the demand for coal minerals oil and gas and water continues to grow globally researchers must prioritize sustainable exploration methods Old technologies are being replaced speedily and exploration work has become fast focused meaningful and readily reproducible keeping in pace with the changing global scenario The themes of exploration of energy resources exploration of minerals groundwater exploration and processing and mineral engineering are separated out into sections and chapters included in these sections include case studies focusing on tools and techniques for exploration Innovative Exploration Methods for Mineral Oil Gas and Groundwater for Sustainable Development gives insight to modern concepts of exploration for those working in the various fields of energy mineral and groundwater exploration Presents innovative research that will both challenge and complement the traditional concepts of exploration Covers a wide range of instruments and their applications as well as the tools and processes that need to be followed for modern exploration work Includes research on groundwater exploration with a focus on conservation and sustainable exploration and development

International Seminar on Coal Science & Technology, 2005

**Biomass Gasification, Pyrolysis and Torrefaction** Prabir Basu, 2013-07-18 Biomass is the most widely used non fossil fuel in the world Biomass resources show a considerable potential in the long term given the increasing proliferation of dedicated energy crops for biofuels The second



edition of Biomass Gasification and Pyrolysis is enhanced with new topics such as torrefaction and cofiring making it a versatile resource that not only explains the basic principles of energy conversion systems but also provides valuable insight into the design of biomass conversion systems This book will allow professionals such as engineers scientists and operating personnel of biomass gasification pyrolysis or torrefaction plants to gain a better comprehension of the basics of biomass conversion The author provides many worked out design problems step by step design procedures and real data on commercially operating systems With a dedicated focus on the design analysis and operational aspects of biomass gasification pyrolysis and torrefaction Biomass Gasification Pyrolysis and Torrefaction Second Edition offers comprehensive coverage of biomass in its gas liquid and solid states in a single easy to access source Contains new and updated step by step process flow diagrams design data and conversion charts and numerical examples with solutions Includes chapters dedicated to evolving torrefaction technologies practicing option of biomass cofiring and biomass conversion economics Expanded coverage of syngas and other Fischer Tropsch alternatives Spotlights advanced processes such as supercritical water gasification and torrefaction of biomass Provides available research results in an easy to use design methodology

Characterization of Porous Solids VI ,2002-11-14 This book contains 99 of the papers that were presented at the 6th in the series of Symposia on Characterization of Porous Solids held in Alicante Spain May 2002 Written by leading international specialists in the subject the contributions represent an up to date and authoritative account of recent developments around the world in the major methods used to characterize porous solids The book is a useful work of reference for anyone interested in characterizing porous solids such as MCM 41 mesoporous materials pillared clays etc Papers on pore structure determination using gas adsorption feature strongly together with papers on small angle scattering methods mercury porosimetry microcalorimetry scanning probe microscopies and image analysis

The Enigmatic Realm of **Fundamental Issues In Control Of Carbon Gasification Reactivity**: Unleashing the Language is Inner Magic

In a fast-paced digital era where connections and knowledge intertwine, the enigmatic realm of language reveals its inherent magic. Its capacity to stir emotions, ignite contemplation, and catalyze profound transformations is nothing in short supply of extraordinary. Within the captivating pages of **Fundamental Issues In Control Of Carbon Gasification Reactivity** a literary masterpiece penned with a renowned author, readers attempt a transformative journey, unlocking the secrets and untapped potential embedded within each word. In this evaluation, we shall explore the book's core themes, assess its distinct writing style, and delve into its lasting effect on the hearts and minds of people who partake in its reading experience.

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