



# Fluid Catalytic Cracking Handbook

An Expert Guide to the Practical Operation,  
Design, and Optimization of FCC Units

Reza Sadeghbelgi



# Fluid Catalytic Cracking Handbook Second Edition An Expert Guide To The Practical Operation Design And Optimization Of Fcc Units Chemical Engineering

**WJ Hussar**



## **Fluid Catalytic Cracking Handbook Second Edition An Expert Guide To The Practical Operation Design And Optimization Of Fcc Units Chemical Engineering:**

**Fluid Catalytic Cracking Handbook** Reza Sadeghbeigi, 2000-06-08 This thoroughly updated edition of Fluid Catalytic Cracking Handbook provides practical information on the design operation troubleshooting and optimization of fluid catalytic cracking FCC facilities Based on the author's years of field experience this expanded second edition covers the latest technologies to improve the profitability and reliability of the FCC units and provides several no to low cost practical recommendations A new chapter supplies valuable recommendations for debottlenecking and optimizing the performance of cat cracker operations

*Multiphase Reactor Engineering for Clean and Low-Carbon Energy Applications* Yi Cheng, Fei Wei, Yong Jin, 2017-02-22 Provides a comprehensive review on the brand new development of several multiphase reactor techniques applied in energy related processes Explains the fundamentals of multiphase reactors as well as the sophisticated applications Helps the reader to understand the key problems and solutions of clean coal conversion techniques Details the emerging processes for novel refining technology clean coal conversion techniques low cost hydrogen productions and CO<sub>2</sub> capture and storage Introduces current energy related processes and links the basic principles of emerging processes to the features of multiphase reactors providing an overview of energy conversion in combination with multiphase reactor engineering Includes case studies of novel reactors to illustrate the special features of these reactors

**Fluid Catalytic Cracking Handbook** Reza Sadeghbeigi, 2000-06-08 This updated edition provides practical information on the design operation troubleshooting and optimization of fluid catalytic cracking facilities Covering the latest technologies to improve the profitability and reliability of the FCC units this edition provides several no to low cost practical recommendations A new chapter supplies valuable recommendations for debottlenecking and optimizing the performance of cat cracker operations

**Springer Handbook of Petroleum Technology** Chang Samuel Hsu, Paul R. Robinson, 2017-12-20 This handbook provides a comprehensive but concise reference resource for the vast field of petroleum technology Built on the successful book Practical Advances in Petroleum Processing published in 2006 it has been extensively revised and expanded to include upstream technologies The book is divided into four parts The first part on petroleum characterization offers an in depth review of the chemical composition and physical properties of petroleum which determine the possible uses and the quality of the products The second part provides a brief overview of petroleum geology and upstream practices The third part exhaustively discusses established and emerging refining technologies from a practical perspective while the final part describes the production of various refining products including fuels and lubricants as well as petrochemicals such as olefins and polymers It also covers process automation and real time refinery wide process optimization Two key chapters provide an integrated view of petroleum technology including environmental and safety issues Written by international experts from academia industry and research institutions including integrated oil companies catalyst suppliers licensors and consultants it

is an invaluable resource for researchers and graduate students as well as practitioners and professionals

**Handbook of Biofuels Production** Rafael Luque, Carol Sze Ki Lin, Karen Wilson, James Clark, 2016-05-19 Handbook of Biofuels Production Second Edition discusses advanced chemical biochemical and thermochemical biofuels production routes that are fast being developed to address the global increase in energy usage Research and development in this field is aimed at improving the quality and environmental impact of biofuels production as well as the overall efficiency and output of biofuels production plants The book provides a comprehensive and systematic reference on the range of biomass conversion processes and technology Key changes for this second edition include increased coverage of emerging feedstocks including microalgae more emphasis on by product valorization for biofuels production additional chapters on emerging biofuel production methods and discussion of the emissions associated with biofuel use in engines The editorial team is strengthened by the addition of two extra members and a number of new contributors have been invited to work with authors from the first edition to revise existing chapters thus offering fresh perspectives Provides systematic and detailed coverage of the processes and technologies being used for biofuel production Discusses advanced chemical biochemical and thermochemical biofuels production routes that are fast being developed to address the global increase in energy usage Reviews the production of both first and second generation biofuels Addresses integrated biofuel production in biorefineries and the use of waste materials as feedstocks

**Fluid Catalytic Cracking** J.S. Magee, M.M. Mitchell, 1993-07-23 The primary focus of this book as a whole is on performance performance of the catalyst of its surface of the FCC unit of the feedstocks employed of the analytical methods used to characterize the catalysts and of environmentally directed regulations that govern the production of transportation fuels from petroleum The emphasis on catalyst performance particularly commercial performance essentially dictated that the chapter authors be experienced industrial catalytic chemists and engineers However each author approached the task with a clear cut obligation to connect the roots of the science of FCC catalysis with the technology Fluid Catalytic Cracking Science and Technology has been written for workers in industrial catalysis and academia including graduate students in chemistry or chemical engineering who are interested in acquiring an overall knowledge of one of the world s most important areas of catalysis The book is concise each topic is treated briefly complete all aspects of FCC catalysis are covered and clear anyone involved in this field will find topics of interest

**Advances in Fluid Catalytic Cracking** Mario L. Occelli, 2010-11-30 Refiners efforts to conform to increasingly stringent laws and a preference for fuels derived from renewable sources have mandated changes in fluid cracking catalyst technology Advances in Fluid Catalytic Cracking Testing Characterization and Environmental Regulations explores recent advances and innovations in this important component of petr

**Fluid Catalytic Cracking VII:** , 2011-09-22 Since 1987 the Petroleum Division of the American Chemical Society ACS has sponsored at 3 year intervals an international symposium on fluid cracking catalysts FCC technology This volume collects the recent progress of this technology as reported in the papers

presented during the 232th National Meeting of the ACS in San Francisco September 10 14 2006 Sixty six years after the introduction of the fluid cracking catalyst process it remains the main process of gasoline generation for the estimated 237 millions cars on US roads Catalysts testing and evaluation still remains a subject of interest debate and controversy Lambda sweep testing testing of SO<sub>x</sub> NO<sub>x</sub> and combustion promoters have been discussed in details together with catalyst evaluation for atmospheric residues and metal contaminated oils cracking Of particular interest has been the introduction of novel concept in process design aimed at improving cracked product selectivity such as two stage risers for better gasoline and olefins production and downer technology for high severity processes The importance of solid state nuclear magnetic resonance NMR in the study of crude oils catalysts and reaction products are illustrated by several examples Two contributions describe the use of predictive methods to understand FCC aging and deactivation and personal overviews of the development of SO<sub>x</sub> and combustion promoters technology are presented Presents findings from the tri annual international symposium on fluid cracking catalysts FCC technology sponsored by the Petroleum Division of the American Chemical Society ACS Two contributions describe the use of predictive methods to understand FCC aging and deactivation Personal overviews by the authors of the development of SO<sub>x</sub> and combustion promoters technology **Design and Operation of Fluid Catalytic Cracking Unit Regenerators** Joseph W. Wilson (P.E.), American Institute of Chemical Engineers, 1999

Fluid Catalytic Cracking Handbook Gaurav Vashishit, 2015-08 This is providing practical information and tools that engineers can use to maximize the profitability and reliability of their fluid catalytic cracking operations The updated chapters and new content deliver expertise and know how to an industry that faces significant cost cutting in capital expenditure and R D along with the retirement of technical specialists who are taking existing knowledge out of the industry with them This FCC Handbook provides a valuable easy to understand resource for both experienced and inexperienced engineers and anyone else associated with the FCC process Fluid catalytic cracking FCC is one of the most important conversion processes used in petroleum refineries It is widely used to convert the high boiling high molecular weight hydrocarbon fractions of petroleum crude oils to more valuable gasoline olefinic gases and other products 1 2 3 Cracking of petroleum hydrocarbons was originally done by thermal cracking which has been almost completely replaced by catalytic cracking because it produces more gasoline with a higher octane rating It also produces byproduct gases that are more olefinic and hence more valuable than those produced by thermal cracking *Fluid Catalytic Cracking* V M.L. Occelli, P. O'Connor, 2001-04-27 Catalyst production for the transformation of crudes into gasoline and other fuel products is a billion dollar year business and fluid cracking catalysts FCCs represent almost half of the refinery catalyst market During the cracking reactions the FCC surface is contaminated by metals Ni V Fe Cu Na and by coke deposition As a result the catalyst activity and product selectivity is reduced to unacceptable levels thus forcing refiners to replace part of the recirculating equilibrium FCC inventory with fresh FCC to compensate for losses in catalyst performance About 1 100 tons day of FCC are

used worldwide in over 200 fluid cracking catalyst units FCCUs It is for these reasons that refiners interest in FCC research has remained high through the years almost independantly of crude oil prices However recent oil company mergers and the dissolution of research laboratories have drastically decreased the number of researchers involved in petroleum refining research projects as a result the emphasis of research has shifted from new materials to process improvements and this trend is clearly reflected in the type of papers contained in this volume Modern spectroscopic techniques continue to be essential in the understanding of catalyst performance and several chapters in the book describe the use of  $^{27}\text{Al}$   $^{29}\text{Si}$  and  $^{13}\text{C}$  NMR to study variation in FCC acidity during aging and coke deposition In addition several chapters have been dedicated to the modeling of FCC deactivation and to the understanding of contact times on FCC performance Refiners efforts to conform with environmental regulations are reflected in chapters dealing with sulfur removal metals contaminants and olefin generation

Fluid Catalytic Cracking II Mario L. Occelli,1991 As refiners worldwide meet crude oil quality problems and address environmental issues and regulations development of new fluid catalytic cracking FCC formulations are essential In this volume theoretical and applied aspects of cracking are discussed in chapters dealing with the origin and effects of strong acidity modelling catalyst testing residue processing and additive usage Several chapters combine catalyst design with modern characterization techniques to provide guidance in the difficult problem of cracking metal contaminated feedstocks

**Fluid Catalytic Cracking VI: Preparation and Characterization of Catalysts** Mario L. Occelli,2004-07-06 This volume looks at the recent progress of this technology as reported in the 21 papers presented during the 219th National Meeting of the ACS in New York September 5 11 2003 In addition the volume focuses on the use of modern spectroscopic techniques for the generation of detailed structural analysis required for the advancement of the science of FCC design Other chapters look at the use and importance of solid state nuclear magnetic resonance NMR microcalorimetry and atomic force microscopy AFM to the study of FCCs and discussing strategies to control pollutant emissions from a refinery FCCU and looking at advances in FCC preparation

**Fluid Catalytic Cracking Technology and Operations** Joseph W. Wilson,1997 Fluid catalytic cracking FCC is the dominant conversion process in petroleum refineries and the major contributor to value added in the refining process Successful operation of the FCC unit is critical to the operation of the FCC unit is critical to the operating success of most refineries This book provides a complete and in depth view of FCC process design and operating principles and the current FCC technologies available to the refining industry

*Fluid Cracking Catalysts* Mario L. Occelli,1998-01-05 Reviews recent accomplishments in the field of fluid cracking catalysts FCC Discusses the development of more specialized and effective catalysts and processes as well as the modification of current technology to meet future challenges in fuel refining Written by nearly 50 internationally recognized experts from academia and industry

*Fluid Catalytic Cracking VII* Mario L. Occelli,2007 Since 1987 the Petroleum Division of the American Chemical Society ACS has sponsored at 3 year intervals an international symposium on fluid cracking catalysts FCC technology This volume

collects the recent progress of this technology as reported in the papers presented during the 232th National Meeting of the ACS in San Francisco September 10 14 2006 Sixty six years after the introduction of the fluid cracking catalyst process it remains the main process of gasoline generation for the estimated 237 millions cars on US roads Catalysts testing and evaluation still remains a subject of interest debate and controversy Lambda sweep testing testing of SO<sub>x</sub> NO<sub>x</sub> and combustion promoters have been discussed in details together with catalyst evaluation for atmospheric residues and metal contaminated oils cracking Of particular interest has been the introduction of novel concept in process design aimed at improving cracked product selectivity such as two stage risers for better gasoline and olefins production and downer technology for high severity processes The importance of solid state nuclear magnetic resonance NMR in the study of crude oils catalysts and reaction products are illustrated by several examples Two contributions describe the use of predictive methods to understand FCC aging and deactivation and personal overviews of the development of SO<sub>x</sub> and combustion promoters technology are presented Presents findings from the tri annual international symposium on fluid cracking catalysts FCC technology sponsored by the Petroleum Division of the American Chemical Society ACS Two contributions describe the use of predictive methods to understand FCC aging and deactivation Personal overviews by the authors of the development of SO<sub>x</sub> and combustion promoters technology Fluid Catalytic Cracking III Mario L. Occelli, 1994 Discusses the formulation characterization microactivity and pilot plant testing and product analysis of fluid cracking catalysts Examines the use of modern spectroscopic techniques such as infrared spectroscopy solid state nuclear magnetic resonance spectroscopy and X ray photoelectron spectroscopy for the analysis of FCC catalysts Presents the first use of atomic force microscopy in the study of FCC catalysts Studies the impact of environmental laws on the discovery of novel FCC catalysts

**Advances in Refining Catalysis** Deniz Uner, 2017-03-16 To meet changing market demands that have stringent emission standards and to ensure proper performance in refinery units evaluation of novel catalyst designs and results from material characterization and testing of catalysts are of crucial importance for refiners as well as for catalyst manufacturers This book highlights recent developments in the application of refinery catalysts in selected units such as fluid catalytic cracking FCC hydrogen production for hydroprocessing units hydrotreating hydrocracking and sustainable processing of biomass into biofuels The CFD Simulation of Fluid Catalytic Cracking Novia, 2007 Fluid catalytic cracking FCC is the refinery process used for the conversion of high molecular weight hydrocarbons to produce higher valuable products such as gasoline This research was especially concerned and motivated by the complex hydrodynamic and kinetic problems relating to the operation of FCC riser reactors which affect both the design and optimization strategies The catalytic cracking of hydrocarbons is a complex process due to the many reactions and chemical species involved Therefore the complexities of the reactions have been investigated by lumping together several chemical compounds In this thesis the Eulerian Eulerian multiphase flow and the 3 lump kinetic model were assumed in order to simulate three dimensional hydrodynamics and

cracking reactions occurring in the FCC riser reactors The commercial CFD software FLUENT version 6.2 was used for the modelling of these flow systems Computational fluid dynamics CFD is a powerful computer based design technique that is used to optimize the industrial processes that incorporate complex reacting multiphase flows CFD involves the numerical solution of the conservation equations for mass momentum and energy in the flow geometry of interest along with subsidiary sets of equations The CFD model predicted the flow pattern of the solid and gas and many important aspects of a riser such as the velocity profiles of the phases solids hold up temperature and enthalpy distribution yield distribution and feed injector geometry It has also been used to describe how the FCC parameters such as catalyst to oil ratio CTO affect the final product distribution It was found that the reliability of the estimated parameters and the predicted results were significantly improved when compared to those obtained by other studies especially for gasoline yield

**Fluid Catalytic Cracking**

Mario L. Occelli, 1988



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