1. Record Nr. UNINA9911006771903321

Titolo Periodic operation of reactors / / edited by P.L. Silveston, R.R. Hudgins

Pubbl/distr/stampa Oxford, : Elsevier, 2013

ISBN 1-283-86852-0

0-12-391866-9

Edizione [1st ed.]

Descrizione fisica 1 online resource (792 p.)

Butterworth-Heinemann/IChemE series Periodic operation of reactors Collana

SilvestonPeter L Altri autori (Persone)

HudginsR. R

Disciplina 660.2832

Soggetti Scientific apparatus and instruments

Lingua di pubblicazione Inglese

Formato Materiale a stampa

Livello bibliografico Monografia

Bibliographic Level Mode of Issuance: Monograph Note generali

Nota di bibliografia Includes bibliographical references and index.

Nota di contenuto Front Cover -- Periodic Operation of Reactors -- Copyright -- Contents

-- Preface -- About the Authors -- Chapter 1 Introduction -- 1.1

PERIODIC OPERATION -- 1.2 ORIGINS OF PERIODIC OPERATION -- 1.3 VARIABLES IN PERIODIC OPERATION -- 1.4 CYCLE STRUCTURE IN PERIODIC OPERATION -- 1.5 MEASURING IMPROVEMENT -- 1.6

INHERENTLY PERIODIC PROCESSES -- 1.7 OBJECTIVES OF PERIODIC

OPERATION -- 1.8 STRATEGIES IN PERIODIC OPERATION -- 1.9 **EQUIPMENT FOR PERIODIC OPERATION -- 1.10 REACTION SYSTEMS**

EXAMINED -- 1.11 NEW DIRECTIONS -- 1.12 A BRIEF HISTORY OF THE STUDY OF PERIODIC OPERATION -- Chapter 2 Hydrogenation Processes

-- 2.1 AMMONIA SYNTHESIS -- 2.2 NOX REDUCTION -- 2.3 METHANATION -- 2.4 METHANOL SYNTHESIS -- 2.5 ETHYLENE HYDROGENATION -- 2.6 AROMATICS HYDROGENATION -- 2.7 OSCILLATORY BEHAVIOR -- Chapter 3 Catalytic Oxidation and Reduction of Gases -- 3.1 INTRODUCTION -- 3.2 CO OXIDATION --3.3 SULFUR DIOXIDE OXIDATION -- 3.4 REDUCTION OF SO3 BY CO OVER PLATINUM -- 3.5 REDUCTION OF NITROGEN OXIDES -- 3.6

TRAVELING WAVES IN PACKED BEDS -- Chapter 4 Partial Oxidation and Dehydrogenation of Hydrocarbons -- 4.1 INTRODUCTION -- 4.2

PARTIAL OXIDATION AND REFORMING OF METHANE TO SYNGAS -- 4.3

OXIDATIVE COUPLING OF METHANE -- 4.4 EPOXIDATION -- 4.5

PROPENE AND BUTENE PARTIAL OXIDATION AND AMMOXIDATION --

```
4.6 CATALYTIC DEHYDROGENATION OF PROPANE, BUTANE AND
HIGHER HYDROCARBONS -- 4.7 MALEIC ANHYDRIDE FROM BUTANE --
4.8 ANHYDRIDES AND ALDEHYDES FROM AROMATIC HYDROCARBONS
-- 4.9 AROMATIC NITRILES -- Chapter 5 Combustion Systems -- 5.1
NON-CATALYTIC COMBUSTION REACTIONS -- 5.2 CATALYTIC
COMBUSTION -- 5.3 LOOPING COMBUSTION -- 5.4 SIMULATED LOOP
REACTORS -- Chapter 6 Automotive Exhaust Catalysis -- 6.1 INTERNAL
COMBUSTION ENGINES -- 6.2 MODULATION OF DETOXIFICATION
REACTIONS -- 6.3 MODELING STUDIES -- 6.4 STUDIES ON
MODULATING AUTOMOTIVE EXHAUST.
6.5 EFFECT OF A/F MODULATION ON POISONING AND SINTERING --
6.6 EFFECTS OF IRREGULAR A/F VARIATION -- 6.7 LEAN BURN SPARK-
IGNITED ENGINES -- 6.8 APPLICATION OF NSR TO DIESEL EXHAUSTS --
6.9 DOES A/F MODULATION IMPROVE CONVERTER PERFORMANCE? --
Chapter 7 Polymerization Under Modulation -- 7.1 INTRODUCTION --
7.2 SIMULATION OF POLYMERIZATION UNDER INPUT MODULATION --
7.3 EXPERIMENTS ON POLYMERIZATION UNDER INPUT MODULATION --
7.4 SPONTANEOUS OSCILLATIONS -- 7.5 SATURATION OF POLYMERS --
7.6 ASSESSMENT -- Chapter 8 Catalytic Gas-Solid Reactions -- 8.1
PARTIAL OXIDATION AND OXIDATIVE DEHYDROGENATION OF
HYDROCARBONS -- 8.2 METHANE CRACKING -- 8.3 NON-CATALYTIC
GAS-SOLID REACTIONS -- 8.4 CATALYTIC GASIFICATION UNDER
MODULATION -- 8.5 GASIFICATION EMPLOYING A CIRCULATING SOLID
OXYGEN CARRIER -- 8.6 COMBUSTION IN CIRCULATING FLUIDIZED BEDS
-- 8.7 PERIODIC REACTION SWITCHING -- Chapter 9 Electrochemical
Processes -- 9.1 INTRODUCTION -- 9.2 ELECTROPLATING -- 9.3
ELECTROFORMING -- 9.4 ANODIZATION -- 9.5 ELECTROCHEMICAL
MACHINING AND POLISHING -- 9.6 ELECTROWINNING AND
ELECTROREFINING -- 9.7 GALVANIC CELLS -- 9.8 ELECTROLYTIC
PRODUCTION OF CHEMICALS -- 9.9 APPLICABILITY OF PRINCIPLES OR
PRACTICES TO NON-ELECTROCHEMICAL REACTIONS -- Chapter 10
Modulation of Biological Processes -- 10.1 INTRODUCTION -- 10.2
THEORETICAL CONSIDERATIONS -- 10.3 SUBSTRATE AND FLOW RATE
MODULATION -- 10.4 DISSOLVED OXYGEN MODULATION -- 10.5
CULTURE MEDIUM TUNING -- 10.6 SURVIVAL IN MIXED CULTURES --
10.7 STABILIZATION OF RECOMBINANT CELL CULTURES -- 10.8
APPLICATIONS TO IMMOBILIZED CELLS OR ENZYMES -- 10.9 FED-
BATCH OPERATIONS -- 10.10 OVERVIEW -- Chapter 11 Miscellaneous
Reactions -- 11.1 ETHYL ACETATE FROM ETHYLENE AND ACETIC ACID
-- 11.2 CLAUS REACTION -- 11.3 DEHYDROGENATION OF METHANOL
-- 11.4 DEAMINATION AND ALCOHOL DEHYDRATION REACTIONS.
11.5 PHOTOCATALYTIC DEGRADATION OF AZO DYES -- 11.6 THE
MINIMAL BROMATE REACTION -- 11.7 PROPANOL DEHYDROGENATION
-- 11.8 GLUCOSE OXIDATION -- 11.9 OVERVIEW -- Chapter 12
Modulation of Multiple Reactions -- 12.1 INTRODUCTION -- 12.2
HOMOGENEOUS REACTIONS -- 12.3 SOLIDS CATALYZED REACTIONS --
12.4 COMPETITIVE REACTIONS -- 12.5 METHANE HOMOLOGATION --
12.6 OLIGOMERIZATION OF ETHENE -- 12.7 MODULATION OF MULTIPLE
INPUTS -- Chapter 13 Use of Modulation in Mechanistic Studies -- 13.1
INTRODUCTION -- 13.2 QUALITATIVE APPLICATIONS -- 13.3
QUANTITATIVE APPLICATIONS -- 13.4 MODULATION OF LIGHT
INTENSITY -- 13.5 APPLICATION OF MODULATION TO THE TESTING OF
RIVAL MODELS -- 13.6 OVERVIEW -- Chapter 14 Evaluation of Periodic
Processes -- 14.1 INTRODUCTION -- 14.2 NONLINEAR FREQUENCY
RESPONSE AND HIGHER ORDER FREQUENCY RESPONSE FUNCTIONS --
14.3 ESTIMATION OF THE TIME AVERAGE PERFORMANCE OF PERIODIC
PROCESSES USING NONLINEAR FREQUENCY RESPONSE ANALYSIS -- 14.4
APPLICATION OF NONLINEAR FREQUENCY RESPONSE ANALYSIS FOR THE
```

ESTIMATION OF THE PERIODIC STEADY STATES OF CYCLIC PROCESSES -- 14.5 SUMMARY -- Chapter 15 Pressure Modulation -- 15.1 INTRODUCTION -- 15.2 ACCELERATION OF MASS TRANSFER -- 15.3 SONOCATALYSIS -- 15.4 PERIODIC PRESSURE REDUCTION -- 15.5 COMBINED COMPRESSION AND REACTION -- 15.6 APPLICATION TO RATE AND EQUILIBRIUM MEASUREMENTS -- 15.7 ASSESSMENT AND RESEARCH OPPORTUNITIES -- Chapter 16 Temperature Modulation --16.1 INTRODUCTION -- 16.2 THEORETICAL STUDIES -- 16.3 SIMULATION STUDIES -- 16.4 EXPERIMENTAL STUDIES WITH CONVENTIONAL LABORATORY EQUIPMENT -- 16.5 TEMPERATURE MODULATION OF TRICKLE BEDS -- 16.6 EXPERIMENTAL STUDIES WITH MICROREACTORS -- 16.7 OVERVIEW AND COMMENTS -- Chapter 17 Flow Interruption in Trickle Beds -- 17.1 INTRODUCTION -- 17.2 STEADY-STATE OPERATION OF A TRICKLE BED REACTOR -- 17.3 PERIODIC OPERATION OF TRICKLE BED REACTORS. 17.4 LIQUID FLOW MODULATION WITH MULTIPLE REACTIONS -- 17.5 HYDRODYNAMICS UNDER LIQUID FLOW MODULATION -- 17.6 MODELING OF THE PERIODIC OPERATION OF TRICKLE BED REACTORS --17.7 SUMMARY -- Chapter 18 - Periodic Flow Reversal -- 18.1 THE HEAT-TRAPPING CONCEPT -- 18.2 THEORETICAL ASPECTS -- 18.3 OXIDATION OF VOLATILE ORGANIC COMPOUNDS -- 18.4 OTHER APPLICATIONS OF REVERSE FLOW REACTORS -- 18.5 THERMAL REACTORS -- 18.6 ENDOTHERMIC PROCESSES -- 18.7 MASS TRAPPING REACTORS -- 18.8 BIOFILTERS -- 18.9 MISCELLANEOUS APPLICATIONS -- 18.10 COMMERCIAL APPLICATIONS -- Chapter 19 - Control of Periodically Operated Reactors -- 19.1 FORMULATION OF AN OPTIMAL CONTROL PROBLEM FOR A PERIODICALLY OPERATED REACTOR -- 19.2 CHATTERING CONTROLS -- 19.3 CONTROLS FOR STIRRED SLURRY AND FLUIDIZED BED REACTORS -- 19.4 CONTROLS FOR PACKED BED REACTORS -- 19.5 CONTROL OF PACKED BED REACTORS WITH FLOW-DIRECTION SWITCHING -- 19.6 CONTROL OF SIMULATED MOVING BED CHROMATOGRAPHIC REACTORS -- 19.7 OTHER CONTROL SCHEMES FOR PERIODICALLY OPERATED REACTORS -- 19.8 COMMENTS AND RESEARCH NEEDS -- Chapter 20 Chromatographic Reactors -- 20.1 INTRODUCTION -- 20.2 CONCEPT AND TYPES -- 20.3 GENERAL MODELS -- 20.4 CYCLIC STEADY STATE -- 20.5 PULSE CHROMATOGRAPHIC REACTOR -- 20.6 COUNTERCURRENT MOVING BED CHROMATOGRAPHIC REACTOR -- 20.7 CONTINUOUS ROTATING ANNULAR CHROMATOGRAPHIC REACTOR -- 20.8 STEPWISE. COUNTERCURRENT MULTI-STAGE FLUIDIZED BED CHROMATOGRAPHIC REACTOR -- 20.9 FIXED BED CHROMATOGRAPHIC REACTOR WITH FLOW DIRECTION SWITCHING -- 20.10 EXTRACTIVE REACTOR SYSTEMS -- 20.11 CENTRIFUGAL PARTITION CHROMATOGRAPHIC REACTOR --Chapter 21 Simulated Moving Bed Chromatographic Reactors -- 21.1 OPERATION AND APPLICATION -- 21.2 MODELING AND SIMULATION --21.3 EXPERIMENTAL STUDIES -- 21.4 OTHER REACTOR APPLICATIONS OF SIMULATED MOVING BEDS -- Chapter 22 Pressure and Temperature Swing Reactors. 22.1 CONCEPTS AND TYPES OF PRESSURE SWING REACTORS -- 22.2 MODELS FOR SWING REACTORS -- 22.3 COMPUTATIONAL CONSIDERATIONS -- 22.4 SIMULATIONS OF PRESSURE SWING SYSTEMS -- 22.5 EXPERIMENTAL STUDIES -- 22.6 TEMPERATURE SWING

22.1 CONCEPTS AND TYPES OF PRESSURE SWING REACTORS -- 22.2 MODELS FOR SWING REACTORS -- 22.3 COMPUTATIONAL CONSIDERATIONS -- 22.4 SIMULATIONS OF PRESSURE SWING SYSTEMS -- 22.5 EXPERIMENTAL STUDIES -- 22.6 TEMPERATURE SWING REACTORS -- 22.7 SIMULATION OF TEMPERATURE SWING SYSTEMS -- 22.8 TEMPERATURE SWING REACTOR NETWORKS -- 22.9 EXPERIMENTAL -- 22.10 COMBINED PRESSURE AND TEMPERATURE SWING REACTORS -- 22.11 OVERVIEW AND ASSESSMENT -- Chapter 23 New Directions-Research and Development Challenges -- 23.1 CHALLENGES -- 23.2 NEW DIRECTIONS -- References -- Index.

Sommario/riassunto

This comprehensive review, prepared by 24 experts, many of whom are pioneers of the subject, brings together in one place over 40 years of research in this unique publication. This book will assist R & D specialists, research chemists, chemical engineers or process managers harnessing periodic operations to improve their process plant performance. Periodic Operation of Reactors covers process fundamentals, research equipment and methods and provides "the state of the art" for the periodic operation of many industrially important catalytic reactions. Emphasis is on experimental results, modeling and simulation. Combined reaction and separation are dealt with, including simulated moving bed chromatographic, pressure and temperature swing and circulating bed reactors. Thus, Periodic Operation of Reactors offers readers a single comprehensive source for the broad and diverse new subject. This exciting new publication is a "must have" for any professional working in chemical process research and development. A comprehensive reference on the fundamentals, development and applications of periodic operation Contributors and editors include the pioneers of the subject as well as the leading researchers in the field Covers both fundamentals and the state of the art for each operation scenario, and brings all types of periodic operation together in a single volume Discussion is focused on experimental results rather than theoretical ones; provides a rich source of experimental data, plus process models Accompanying website with modelling data.