Contents

PART 1: POLLUTANT EMISSIONS *1*

Analysis of Multiple Emission Strategies in Energy Markets 3
J. ALAN BEAMON AND ROBERT T. EYNON

Mercury in Illinois Coals: Abundance, Forms, and Environmental Effects 15
ILHAM DEMIR

Characterization of Particulate Matter with Computer-Controlled Scanning Electron Microscopy 29
STEVEN A. BENSON, DONALD P. MCCOLLOR, KURT E. EYLANDS, JASON D. LAUMB AND ROBERT R. JENSEN

Dioxin and Furan Formation in FBC Boilers 43
L. JIA, E.J. ANTHONY AND D.L. GRANATSTEIN

Reducing Emissions of Polyaromatic Hydrocarbons from Coal Tar Pitches 59
JOHN M. ANDRÉSEN, YINZHI ZHANG AND M. MERCEDES MAROTO-VALER

PART 2: CARBON SEQUESTRATION 73

Carbon Sequestration: An Option for Mitigating Global Climate Change 75
ROBERT L. KANE AND DANIEL E. KLEIN

Using a Life Cycle Approach in Analyzing the Net Energy and Global Warming Potential of Power Production via Fossil Fuels with CO_2 Sequestration Compared to Biomass 89
PAMELA L. SPATH

Carbon Storage and Sequestration as Mineral Carbonates 101
DANIEL J. FAUTH, JOHN P. BALTRUS, YEE SOONG, JAMES P. KNOER, BRETT H. HOWARD, WILLIAM J. GRAHAM, M. MERCEDES MAROTO-VALER AND JOHN M. ANDRÉSEN

Sequestration of Carbon Dioxide by Ocean Fertilization 119
MICHAEL MARKELS, JR. AND RICHARD T. BARBER

Polyelectrolyte Cages For A Novel Biomimetic CO_2 Sequestration System 133
FATMA A. SIMSEK-EGE, GILLIAN M. BOND AND JOHN STRINGER

Novel Solid Sorbents for Carbon Dioxide Capture 147
Y. SOONG, M. L. GRAY, AND K. J. CHAMPAGNE , R. W. STEVENS, JR, P. TOOCHINDA AND S. S. C. CHUANG

PART 3: GREENHOUSE GAS EMISSIONS CONTROL 159

Near Zero Emission Power Plants as Future CO_2 Control Technologies 161
P. MATHIEU

Reducing Greenhouse Emissions from Lignite Power Generation by Improving Current Drying Technologies 175
GEORGE FAVAS, ALAN L. CHAFFEE AND W. ROY JACKSON

Reduction Process of CO_2 Emissions by Treating With Waste Concrete via an Artificial Weathering Process 189
AKIHIRO YAMASAKI, MINORU FUJII, MASAYUKI KAKIZAWA AND YUKIO YANAGISAWA

Understanding Brown Coal-Water Interactions to Reduce Carbon Dioxide Emissions 203
LEIGH M. CLEMOW, W.ROY JACKSON, ALAN L. CHAFFEE, RICHARD SAKUROVS AND DAVID J. ALLARDICE

High Temperature Combustion of Methane over Thermally Stable CoO-MgO Catalyst for Controlling Methane Emissions from Oil/Gas-Fired Furnaces 217
VASANT R. CHOUDHARY, SUBHABRATA BANERJEE, AJIT S. MAMMAN AND SURYAKANT G. PATASKAR

Dual-Bed Catalytic System for Removal of NO_x-N_2O in Lean-Burn Engine Exhausts 229
A.R. VACCARO, J. PÉREZ-RAMÍREZ, J.M. GARCÍA-CORTÉS, C. SALINAS-MARTÍNEZ DE LECEA, G.MUL, F. KAPTEIJN AND J.A. MOULIJN

PART 4: UTILIZATION OF CO_2 FOR SYNTHESIS GAS PRODUCTION *245*

Tri-reforming of Natural Gas Using CO_2 in Flue Gas of Power Plants without CO_2 Pre-separation for Production of Synthesis Gas with Desired H_2/CO Ratios 247
CHUNSHAN SONG, WEI PAN AND SRINIVAS T. SRIMAT

Effect of Pressure on Catalyst Activity and Carbon Deposition During CO_2 Reforming of Methane over Noble-Metal Catalysts 269
ABOLGHASEM SHAMSI AND CHRISTOPHER D. JOHNSON

CO_2 Reforming of CH_4 to Syngas over Ni Supported on Nano-γ-Al_2O_3 285
JUN-MEI WEI, BO-QING XU, JIN-LU LI, ZHEN-XING CHEN AND QI-MING ZHU

Oxy-CO_2 Reforming and Oxy-CO_2 Steam Reforming of Methane to Syngas over $Co_xNi_{1-x}O$/MgO/SA-5205 299
V.R.CHOUDHARY, A.S. MAMMAN AND B.S.UPHADE

Carbon Routes In Carbon Dioxide Reforming of Methane 313
L. PINAEVA, Y. SCHUURMAN AND C. MIRODATOS

PART 5: UTILIZATION OF CO_2 FOR CHEMICAL SYNTHESIS 329

Life Cycle Assessment (LCA) applied to the synthesis of methanol. Comparison of the use of syngas with the use of CO_2 and dihydrogen produced from renewables 331
MICHELE ARESTA, ANTONELLA CAROPPO, ANGELA DIBENEDETTO AND MARCELLA NARRACCI

Reduction of CO_2 in Steam Using a Photocatalytic Process to Form Formic Acid 349
DIRK D. LINK AND CHARLES E. TAYLOR

Carbon Dioxide As a Soft Oxidant: Dehydrogenation of Ethylbenzene Into Styrene 359
SANG-EON PARK, JONG-SAN CHANG AND JIN S. YOO

CO_2 as a C_1-Building Block for Dialkyl Carbonate Synthesis 371
DANIELLE BALLIVET-TKATCHENKO, HENRY CHERMETTE AND THOMAS JERPHAGNON

PART 6: COMBUSTION BYPRODUCTS 385

An Investigation of the Characteristics of Unburned Carbon in Oil Fly Ash 387
YA-MIN HSIEH AND MIN-SHING TSAI

Separation of Fly Ash Carbons by Various Cleaning Processes 403
MCMAHAN L. GRAY, KENNETH J. CHAMPAGNE, YEE SOONG , RICHARD P. KILLMEYER, JOHN BALTRUS, M. MERCEDES MAROTO-VALER, JOHN M. ANDRÉSEN, MICHAEL V. CIOCCO AND PAUL H. ZANDHUIS

Design Approaches for Passive Treatment of Coal Combustion Byproduct Leachate 417
KEVIN L. HOOVER AND TERRY A. RIGHTNOUR

Development of Value-Added Products from Fly Ash Carbons 431
M. MERCEDES MAROTO-VALER, YINZHI ZHANG, ZHE LU, JOHN M. ANDRÉSEN AND HAROLD H. SCHOBERT

Index 445