

**SPECIALTY ZEOLITES IN CATALYSIS, 2002-2020:  
INTERNATIONAL, COMMERCIAL AND TECHNICAL PROGRESS –  
A NEW ERA!**

**MULTI-CLIENT STUDY PRESENTATION**

**(study completed February 2014)**



## **SPECIALTY ZEOLITES IN CATALYSIS, 2002-2020: INTERNATIONAL, COMMERCIAL AND TECHNICAL PROGRESS – A NEW ERA!**

### **I. BACKGROUND**

The Catalyst Group Resources (TCGR) has been recognized as the definitive source for information on the use of specialty zeolites in catalysis throughout the 1980's, the 1990's and when completing TCGR's last benchmarking report *Specialty Zeolites in Catalysis: 1992-2001* in June, 2002. It is now 2014 and this update report has been generated to capture the global, commercial and technical changes that have occurred over the last decade, defined as the use of zeolites beyond A, X, and Y.

In addition to documenting the historical developments of 2002 to 2012, this new report, for the first time, takes a forward looking forecast into the future (2013-2020). There is a powerful reason for this change! Zeolites, already a robust and selective catalyst, will no doubt play an increasing role in energy efficiency and therefore in the reduction of greenhouse gases (GHGs) generated in process reactions.

In highlighting the importance of zeolites to the global economy, the World Technology Evaluation Center Inc. (WTEC) on behalf of the National Science Foundation (NSF) and in support of the National Science and Technology Council (NSTC) recently released a report entitled *Nanotechnology Research Directions for Societal Needs in 2020* (see <http://wtec.org/nano2/>).

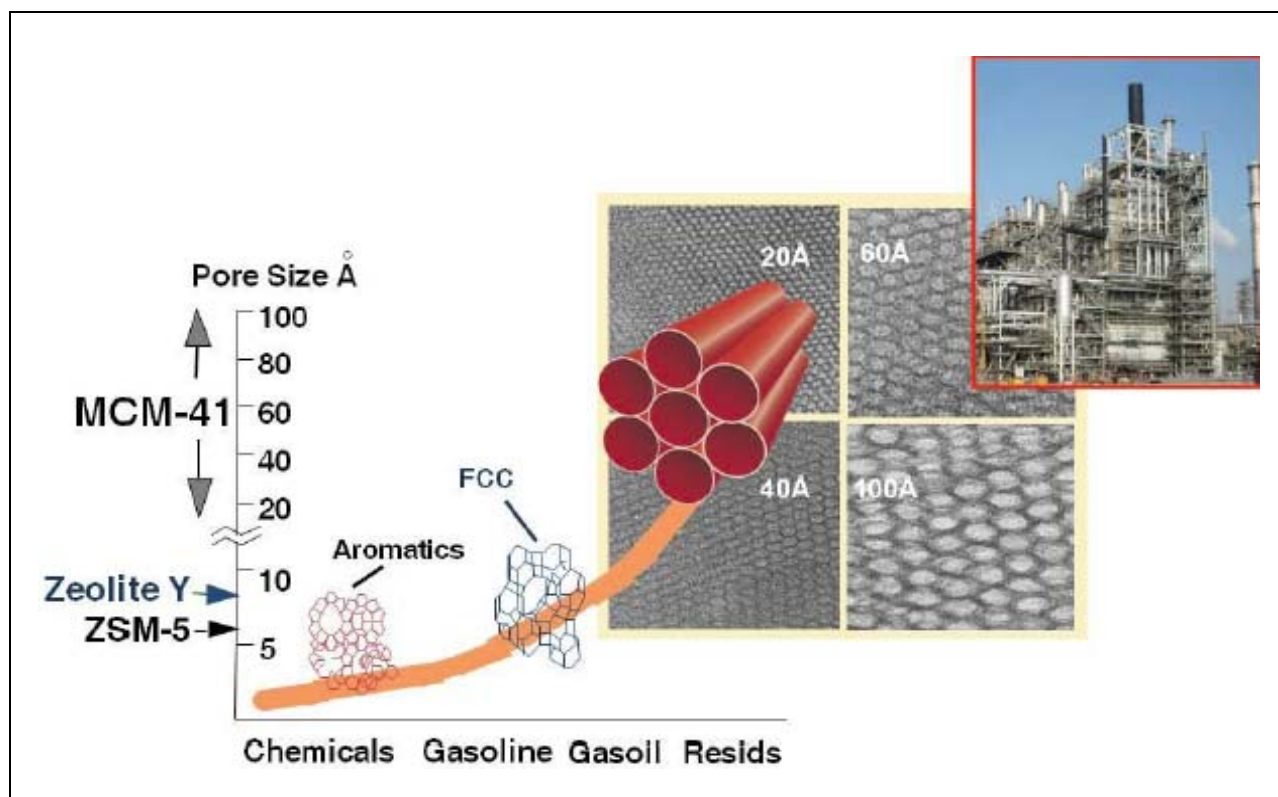
In that study, coined "Nano 2," it was stated by TCGR (Chapter 10, p. 346) that 30-40% or more of global catalyst products, valued at \$18-20 BIL/year (at that time), incorporated modern nanotechnology, in which zeolites with tailored framework structures are used for shape selective chemicals and fuel processing. In refining and petrochemicals (aromatics) production, this percentage is significantly higher. Thus, keeping detailed track of this expanding technology and its process developments is of vital importance to industry. This is highlighted in Figure 1 (page 2).

In our 2002 report, we focused on providing a detailed capacity by process buildup analysis of specialty zeolite catalysts usage in refining, petrochemicals and fine and intermediate chemicals. It provided significant detail on the use of these catalysts in each application by company. That analysis, due to its breadth and depth, made up the bulk of the last report. In this 2014 update, "*Specialty Zeolites in Catalysis, 2002-2020: International, Commercial and Technical Progress – A New Era!*," we update yet condense this coverage since the detail can be obtained from the previous report on technical application (see Figure 2, page 3). This new volume spends time on new uses, or more rapidly expanding market segments, of interest to zeolite and/or catalyst producers.

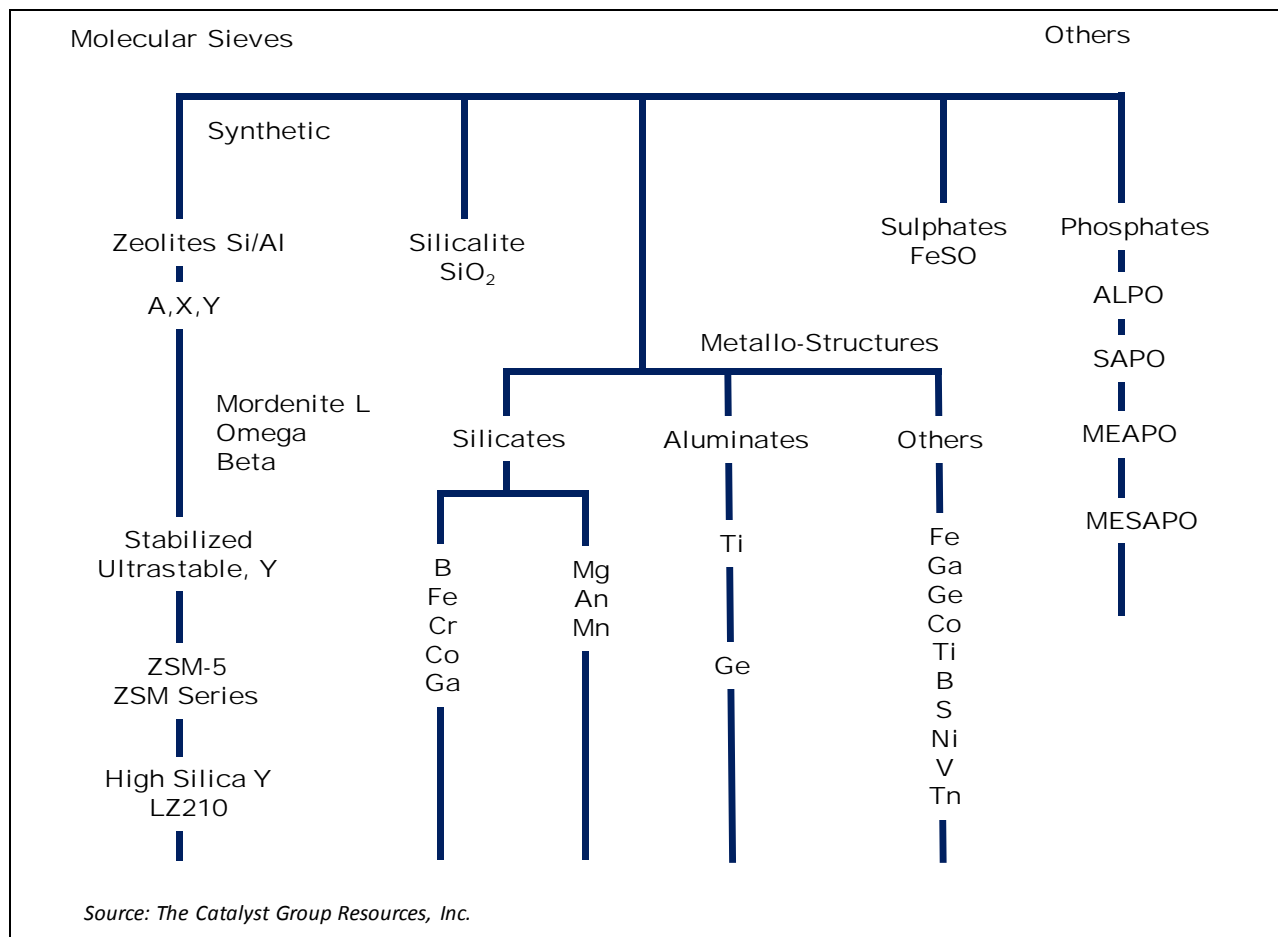
This report does not aim to duplicate the same scope of coverage, but rather compares and contrasts 2002 findings, adding new applications and commercial competitive perspectives that have changed. In fact, so that subscribers in this update are brought up to speed, TCGR has made the 2002 report available for a nominal additional fee.

For TCGR's reports in the zeolites area, we have the assistance of the world's most renowned zeolite experts. The 2002 report was authored with the assistance of Dr. Wolfgang Holderich, University of Aachen, ex BASF and Dr. Art Chester, formerly of ExxonMobil (retired), who also obtained oversight from other leaders. In earlier studies, other contributors have been Dr. George Kokotailo, formerly of Mobil, Dr. Sigmund Csicsery, formerly of Chevron Research, and Dr. Tomoyuki Inui, retired from the University of Tokyo. For this 2014 update, we have continued our usage of the world's leading technical and commercial experts including Bill Borghard (ex ExxonMobil), Jim D'Auria (ex UOP) and Vince Durante (ex Sunoco and BASF), among others. As an active participant in the International Zeolite Association (IZA) through its Dialog Group®, TCGR's expertise is well-recognized by all industry participants.

**Figure 1**  
**Examples of Nanotechnology in Commercial Catalysis Products**  
**for Applications in Oil Refining 2010 (Nano2)**



**Figure 2**  
**Historical Development of New Zeolites**



## II. THE NEED FOR THE STUDY

Not surprisingly, this is a high growth market segment. When last benchmarked in 2002, applications growth exceeded +12% annually! Equally important, specialty zeolites and specialty zeolite catalysts commanded both a premium price and margin due to their highly selective and value-added contribution in production, advancing both yield and selectivity. Therefore, applications R&D and expansion of specialty zeolites usage are expected to continue to be a high investment priority.

Information from other sources is “sparse” at best because detailed knowledge and participation within these applications is a prerequisite to understanding both the market and the business in order to define the opportunities. As a result of the nature and importance of this sector, it is shrouded in industrial secrecy. The Catalyst Group Resources (TCGR) is uniquely positioned with the skill and knowledge to assemble this report update.

Two growth segments in zeolites come immediately to mind and are worthy of special cameos: 1) environmental catalysts; and 2) the growth in Asia/Pacific, which is more sophisticated in China in particular. To highlight these examples, we mention the increasing use of metallo-zeolites in diesel automotive oxidation catalysis – but there are others. On the Asia/Pacific front, we highlight the expanding use of Sinopec’s licensed deep catalytic cracking (DCC) process for the selective production of olefins, but there are others in commercial/pilot development (e.g., catalytic pyrolysis).

There is a periodic need for this timely study to benchmark the progress, as well as document the commercial opportunities available for the future.

This newly updated report “**Specialty Zeolites in Catalysis, 2002-2020: International, Commercial and Technical Progress – A New Era!**” complements an ongoing portfolio of similarly well-received studies TCGR has delivered to clients over recent years. This growing experience demonstrates TCGR’s unique capability, resources, and expertise to deliver exceptional insight.

Recent multi-client reports and studies from our current membership-directed programs include:

- *The Industrial Adsorbents Business: Commercial Strategy, Technical and R&D Assessment in Refining, Chemicals/Syngas, Natural Gas and Industrial Gases (July 2013)*
- *Unconventional Catalytic Olefins Production: Commercial Vision and Breakout? (January 2013)*
- *The Intelligence Report: Business Shifts in the Global Catalytic Process Industries, 2011-2017 (May 2012)*
- *Advances in Catalytic Production of Olefins (April 2012)*
- *Advances in Refinery Cracking Catalysts and Processes (June 2012)*

### **III. SCOPE AND METHODOLOGY**

As depicted in the report’s Table of Contents (see pages 6-13), TCGR’s study begins by completing an overview of the current industry players and the commercial landscape (**Section III**). It presents an understanding of licensed processes, applications and product properties and provides a commercial review of the recent past (with historical points) as well as a description of the current competitive environment.

The market size and growth of specialty zeolite catalysts by process and industry have been evaluated, updated and shown by industry segment (e.g. refining, petrochemicals/aromatics, chemicals, fine chemicals, intermediates, and environmental) in **Section IV**. As described earlier, past/historical information has been updated and condensed, whereas existing applications that are important growth areas in the future are documented in more detail.

**Section V**, New Applications and Growth Markets (“Cameos”), consists of cameos on two focused (i.e., charter subscriber directed) growth segments: 1) Asia/Pacific (China); and 2) environmental. The first is geographically focused, the second, applications focused.

**Section VI**, Recent R&D Advances in Zeolites 2002-2012, captures developments over the last decade in newer zeolites by type, a patent analysis for this period by application and company, as well as a summary of future trends envisaged derived from this set of information and a detailed technical knowledge of the field.

**Section VII**, Commercial Strategy, Competition and Barriers to Entry, provides a more insightful analysis of critical points in commercial developments. Issues of manufacturing capacity, process licensing and global positioning are evaluated. This section is expanded and more interesting due to the impacts of the forward looking timeframe to 2020.

**TCGR’s unique background and historical development roots in zeolites (ex Union Carbide) provides an unparalleled capability and skill level in this study area. Deep expertise in materials science and process engineering means the ability to provide insights beyond other sources that do not have the industrial experience TCGR and our Dialog Group® can provide.**

For those that understand and appreciate this study undertaking, you will know how important and critically timely this evaluation is! We are standing at a critical crossroads as it pertains to the path towards 2020. The next 5-10 years are certain to be telling. Thus, TCGR’s study is warranted.

*In order to heighten the value-added from study participation, TCGR worked with “charter” subscribers (i.e., those who signed up for the study before its launch) in order to define the scope of the report by delineating areas of particular interest for inclusion in the assessment.*

*TCGR has also made immediately available the 2002 edition of the report, entitled **Specialty Zeolites in Catalysis: 1992-2001**, for the nominal fee of \$2,500. This provides a basis for subscribers to obtain a fundamental understanding of the industry’s history, players, products and environment.*

# **SPECIALTY ZEOLITES IN CATALYSIS, 2002-2020: INTERNATIONAL, COMMERCIAL AND TECHNICAL PROGRESS – A NEW ERA!**

## **Table of Contents**

<b>SECTION I. INTRODUCTION/BACKGROUND .....</b>	<b>1</b>
A. INTRODUCTION.....	1
B. BACKGROUND .....	2
C. THE STUDY TEAM.....	3
D. GLOSSARY .....	5
<b>SECTION II. EXECUTIVE SUMMARY .....</b>	<b>7</b>
<b>SECTION III. COMMERCIAL LANDSCAPE AND SUPPLIER PORTFOLIOS.....</b>	<b>21</b>
A. LICENSED PROCESSES, APPLICATIONS AND PRODUCTS .....	21
B. COMPETITOR PROFILES .....	23
1. Albemarle.....	23
2. Axens .....	25
3. BASF .....	26
4. Clariant .....	28
5. ExxonMobil .....	30
6. Grace Catalyst Technologies.....	32
7. Johnson Matthey/Intercat .....	34
8. Showa Denko .....	35
9. SK Innovation .....	36
10. Tosoh.....	37
11. UOP .....	39
12. Zeochem.....	41
13. Zeolyst .....	42
C. MANUFACTURING CAPACITY BY SUPPLIERS.....	44
1. Total Manufacturing Capacity .....	44
2. Changes in Specialty Zeolite Production Capacity by Company .....	45

D. COMPETITIVE ENVIRONMENT, BUSINESS DEVELOPMENT .....	47
1. Market Positions of Key Competitors .....	47
2. Mergers and Acquisitions.....	49
3. Partnerships and Technology Licensing Agreements.....	50
E. CONCLUSIONS .....	53
F. REFERENCES.....	53
G. BIBLIOGRAPHY.....	54
<b>SECTION IV. MARKET SIZE AND GROWTH BY INDUSTRY, PROCESS .....</b>	<b>55</b>
A. REFINING PROCESSES.....	55
1. Fluid Catalytic Cracking .....	56
a. Grace OlefinsUltra Additives.....	56
b. Sinopec DCC and MIP.....	56
c. CCIC OCTUP Additives .....	56
d. Albemarle Upgrader, AFX and BMCT .....	57
e. Axens-Technip Stone & Webster HS-FCC .....	57
f. Additives in FCC Units.....	57
2. Diesel Fuel Production.....	58
a. Clariant COD Process .....	58
3. Dewaxing .....	59
a. ExxonMobil MIDW, MSDW/MAXSAT .....	59
b. Shell Global Solutions Shell Dewaxing .....	60
c. Chevron Lummus Global Isodewaxing/Isosfinishing .....	60
d. SK SDX.....	61
e. Sinopec Hydrodewaxing .....	61
f. Clariant HYDEX .....	61
4. Gasoline Benzene Reduction .....	61
a. ExxonMobil BenzOUT .....	61
5. Paraffin Isomerization .....	62
6. Methanol to Gasoline .....	62
a. ExxonMobil MTG .....	62
b. Clariant CMG Catalyst .....	62



B.	PETROCHEMICAL PROCESSES.....	63
1.	Light Olefin Production .....	63
a.	Propylene from Olefin Cracking.....	63
b.	Light Olefins from Methanol.....	65
c.	New Light Olefin Processes in the Pipeline.....	67
2.	Aromatics Production.....	68
a.	Aromatics and Aromatic Derivatives.....	68
b.	Xylene Isomerization .....	69
c.	Transalkylation and Disproportionation .....	71
d.	Ethylbenzene Production.....	72
e.	Cumene Production.....	74
C.	FINE CHEMICALS AND INTERMEDIATES .....	75
D.	ENVIRONMENTAL (MOBILE AND STATIONARY).....	77
E.	HISTORICAL AND FORECASTED GROWTH BY INDUSTRY, 2002-2012, 2013-2020.....	79
1.	Data Analysis and Findings in the Forecasts by Application .....	80
a.	Refining .....	80
b.	Chemicals.....	82
c.	Olefins. ....	83
d.	Fine Chemical and Intermediates.....	84
e.	Environmental.....	84
F.	MARKET TRENDS SUMMARY .....	84
G.	ANALYSIS & CONCLUSIONS .....	85
H.	REFERENCES.....	88
I.	BIBLIOGRAPHY .....	91
<b>SECTION V. NEW APPLICATIONS AND GROWTH MARKETS (“CAMEOS”).....</b>		<b>95</b>
A.	CHINA – OVERVIEW PERSPECTIVE .....	95
1.	Rapid Growth in Domestic Specialty Zeolite Manufacturing Capacity .....	95
2.	Increasing Domestic Competition .....	96
3.	Domestic Manufacturers Slowly Expanding Foreign Sales .....	96
4.	Chinese Competitor Profiles .....	97
a.	Sinopec.....	97
b.	XinNian Petrochemical Additives .....	99
c.	CT energy.....	100

d. QHX .....	101
5. Conclusion .....	102
B. ZEOLITE CATALYSIS FOR BIOMASS CONVERSION – AN UPDATE .....	103
1. Catalytic Fast Pyrolysis .....	104
2. Shape-selectivity of Zeolite Catalysts for Biomass Conversion Reactions ..	107
3. Renewable Petrochemicals from the Upgrading of Pyrolysis Oils .....	109
4. Sugar Conversion with Zeolite Catalysts .....	112
a. Dehydration of Sugars to Furans and Acids .....	112
b. Isomerization of Sugars .....	113
5. Conclusions .....	114
C. REFERENCES .....	115
D. BIBLIOGRAPHY .....	123
<b>SECTION VI. RECENT R&amp;D ADVANCES IN ZEOLITES 2002-2012.....</b>	<b>125</b>
A. LITERATURE ANALYSIS/REVIEW .....	125
1. Patents .....	125
a. ExxonMobil .....	125
b. Chevron .....	126
c. UOP .....	128
d. ITQ.....	128
e. BASF .....	129
2. Scientific Literature .....	129
3. Commercial Literature.....	131
a. Biofuels/Biochemicals.....	131
b. Gas-to-Liquids .....	133
c. Other.....	134
B. NEW ZEOLITES.....	136
1. New Zeolites/Frameworks (IZA) and Their Synthesis.....	136
a. Very Large Pore (>12MR).....	137
b. Large Pore (12MR).....	139
c. Medium Pore (10-11MR) .....	141
d. Small Pore (8MR) .....	142
e. Theoretical .....	143
2. Novel Synthesis Techniques.....	143
3. Modifications/Functionalization .....	146

4. Commercial Variations.....	148
5. Membranes.....	148
6. Analogs, Zeo-types, Layered, ZIF's, MOF's .....	150
a. Phosphates, Phosphites.....	150
b. Ordered Mesoporous Materials .....	150
c. Layered Zeolites.....	151
d. ZIF's.....	151
e. MOF's.....	153
f. Composites.....	154
C. CHARACTERIZATION – ADVANCES IN TECHNIQUES FOCUSED ON ZEOLITES.....	154
1. Novel Techniques .....	155
a. Structure Solution .....	155
b. Operando.....	156
c. Other.....	157
2. Techniques Readily Applied to R&D and Manufacturing .....	159
D. IMPROVEMENTS IN ZEOLITE MANUFACTURING.....	159
1. Scale and Throughput .....	159
2. Green Synthesis .....	159
E. FUTURE ZEOLITE TECHNOLOGY FOR THE NEXT 5-10 YEARS.....	160
1. Novel Approaches to Zeolite Synthesis .....	160
F. PROPOSED R&D AND INVESTMENT DIRECTIONS .....	161
G. REFERENCES.....	161
<b>SECTION VII. COMMERCIAL STRATEGY, COMPETITION AND BARRIERS TO ENTRY.....</b>	<b>175</b>
A. EVALUATION OF TRENDS, COMPETITION, AND CHALLENGES.....	175
1. Markets and Applications.....	175
a. FCC Additives for Olefin Production.....	175
b. Aromatics Production .....	178
c. Biomass Processing .....	178
d. Environmental Applications .....	179
2. Progress in New Materials .....	180
B. STRATEGY FOR IMPLEMENTATION .....	182
1. R&D Investment.....	183

a. Going Green and Lowering Cost .....	183
b. Post Synthesis Functionalization .....	184
C. REFERENCES .....	186
<b>SECTION VIII. CONCLUSIONS AND RECOMMENDATIONS .....</b>	<b>189</b>

## FIGURES

Figure I-A-1	Examples of Nanotechnology in Commercial Catalysis Products for Applications in Oil Refining 2010 (Nano2) .....	2
Figure II-ES-1	Specialty Zeolite Production Capacity by Region, 2013 .....	12
Figure II-ES-2	Global Refined Products Demand Forecast .....	15
Figure III-C-1	Specialty Zeolite Production Capacity by Region, 2013 .....	45
Figure IV-A-1	Global Refined Products Demand Forecast .....	55
Figure IV-A-2	UOP's RxPro Process .....	58
Figure IV-B-1	Sinopec EBLC Ethylbenzene Production Process .....	68
Figure IV-D-1	BTE comparisons for various engine technologies and sensitivity to turbocharger efficiency .....	78
Figure IV-D-2	General advance HD engine technologies and the resultant urea (DEF) and fuel cost curves, assuming DEF costs \$2.56 per gallon (\$0.69/liter) and diesel fuel cost \$3.89/gallon (\$1.05/liter). Fluid costs are minimized at 8-11 g/kW-hr NOx .....	79
Figure V-B-1	Schematic of aromatic production by catalytic fast pyrolysis of biomass. ....	105
Figure V-B-2	Reaction chemistry for the production of aromatics and olefins from catalytic fast pyrolysis (CFP) of lignocellulosic biomass. ....	106
Figure V-B-3	Schematic of the KiOR process for converting biomass to renewable fuels.....	108
Figure V-B-4	Hydrolysis of polysaccharides and the dehydration of sugars (glucose and xylose) to furans (furfural and hydroxymethylfurfural) and levulinic and formic acids, using zeolite acid catalysts. ....	112
Figure V-B-5	Isomerization reaction of glucose to fructose in water proceeds by way of an intermolecular hydride shift rather than proton transfer over Sn-Beta zeolite. Lewis acid site is shown.....	114
Figure VI-B-1	Total Approved IZA Structures over Time .....	137
Figure VI-B-2	ITV Topology .....	138
Figure VI-B-3	a) IRR Topology; b) ITT Topology; c) IFO Topology .....	138
Figure VI-B-4	ITQ-43.....	139
Figure VI-B-5	a) IWS Topology; b) SOF Topology; c) BSV Topology.....	139

Figure VI-B-6	a) SSF Topology; b) UWY Topology; c) SFV Topology .....	140
Figure VI-B-7	Schematic of ZSM-5 as Thin Sheets .....	145
Figure VI-B-8	pH Drop vs Al Insertion.....	147
Figure VI-B-9	Schematic of Zeolite Development Strategy .....	148
Figure VI-B-10	Microscopy at Different Magnifications Showing Hierarchical Structure .....	149
Figure VI-B-11	Structure of ZIF-8 .....	152
Figure VI-B-12	Schematic of Selective Hydrogenation by Composite Catalyst..	154
Figure VI-C-1	Schematic of Operando: Spectroscopy During Reaction. ....	157
Figure VI-C-2	Location of Metal Atoms in Zeolite by AC-STEM .....	158

## TABLES

Table II-ES-1	Commercial Applications of Specialty Zeolite Catalysts by Segment, 2002, 2012, 2020 (mt/yr, '000 BPD).....	8
Table II-ES-2	Commercialized Use of Specialty Zeolites .....	9
Table II-ES-3	Recently Introduced Specialty Zeolite Catalysts by Application, 2002–2013.....	10
Table II-ES-4	New Specialty Zeolite-based Processes, 2002-2013 .....	11
Table II-ES-5	Changes in Specialty Zeolite Manufacturing by Facility Since 2002.....	13
Table II-ES-6	Key Acquisitions of Specialty Zeolite Manufacturers, 2002–2013.....	14
Table III-A-1	Commercialized Use of Specialty Zeolites .....	21
Table III-A-2	Recently Introduced Specialty Zeolite Catalysts by Application, 2002–2013.....	22
Table III-A-3	New Specialty Zeolite-based Processes, 2002-2013 .....	23
Table III-B-1	Albemarle Key Characteristics & SWOT Analysis.....	25
Table III-B-2	Axens Key Characteristics & SWOT Analysis .....	26
Table III-B-3	BASF Key Characteristics & SWOT Analysis.....	28
Table III-B-4	Clariant Characteristics & SWOT Analysis.....	30
Table III-B-5	ExxonMobil Process Installations .....	32
Table III-B-6	ExxonMobil Characteristics & SWOT Analysis.....	32
Table III-B-7	W.R. Grace Key Characteristics & SWOT Analysis .....	33
Table III-B-8	Johnson Matthey Key Characteristics & SWOT Analysis.....	35
Table III-B-9	Showa Denko Key Characteristics & SWOT Analysis.....	36
Table III-B-10	SK Innovation Key Characteristics & SWOT Analysis.....	37

Table III-B-11	Tosoh Key Characteristics & SWOT Analysis .....	39
Table III-B-12	UOP Key Characteristics & SWOT Analysis .....	41
Table III-B-13	Zeochem Key Characteristics & SWOT Analysis .....	42
Table III-B-14	Zeolyst Characteristics & SWOT Analysis .....	44
Table III-C-1	Changes in Specialty Zeolite Manufacturing by Facility Since 2002.....	46
Table III-D-1	Representative Specialty Zeolite Market Applications by Company .....	48
Table III-D-2	Key Acquisitions of Specialty Zeolite Manufacturers, 2002–2013.....	50
Table III-D-3	Specialty Zeolite Joint Ventures, Licensing Agreements/Co-development .....	52
Table IV-C-1	Commercial Applications of Specialty Zeolite Catalysts by Segment, 2002, 2012, 2020 (mt/yr, '000 BPD).....	76
Table IV-E-1	New Light Olefins Processes, K MTA Olefin Capacity, 2012-2020 .....	83
Table V-A-1	Specialty Zeolite Manufacturers in China .....	95
Table V-A-2	Sinopec Key Characteristics & SWOT Analysis .....	99
Table V-A-3	XinNian Petrochemical Additives Company Characteristics & SWOT Analysis.....	100
Table V-A-4	CT Energy Characteristics & SWOT Analysis .....	101
Table V-A-5	QHX Characteristics & SWOT Analysis.....	102
Table V-B-1	Summary of Some of the Current Companies Utilizing Zeolites for Biomass Conversion .....	111
Table VI-A-1	Recent ExxonMobil Patented Materials.....	126
Table VI-A-2	Recent Chevron Patented Materials.....	126
Table VI-A-3	Recent UOP Patented Materials.....	128
Table VI-A-4	Recent ITQ Patented Materials .....	129
Table VI-B-1	Recently IZA Approved Very Large Pore Materials .....	137
Table VI-B-2	Recently IZA Approved Large Pore Materials .....	139
Table VI-B-3	Recently IZA Approved Medium Pore Materials.....	141
Table VI-B-4	Recently IZA Approved Small Pore Materials.....	142
Table VI B-5	Recently IZA Approved New Structures .....	143

#### IV. QUALIFICATIONS

The Catalyst Group Resources, a member of The Catalyst Group, works with clients to develop sustainable competitive advantage in technology-driven industries such as chemicals, refining, petrochemicals, polymers, specialty/fine chemicals, biotechnology, pharmaceuticals, and environmental protection. We provide concrete proven solutions based on our understanding of how technology impacts business.

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The client-confidential assignments conducted by The Catalyst Group include projects in:

- Reinventing R&D pipelines
- Technology alliances
- Technology acquisition
- Market strategy

We have built our consulting practice on long-term client relationships, dedication, and integrity. Our philosophy is clear and focused:

***We Provide the "Catalysts" for Business Growth by Linking Technology and Leading-Edge Business Practices to Market Opportunities***

## **V. DELIVERABLES AND PRICING**

This report is timely and strategically important to those industry participants and observers considering investment, as well as to process technology companies evaluating the specialty zeolite markets. TCGR's report, based on technology evaluations, market assessments and interviews with key players goes beyond public domain information. As a result, subscribers are requested to complete and sign the "Order Form and Secrecy Agreement" on the following page.

The study, "***Specialty Zeolites in Catalysis, 2002-2020: International, Commercial and Technical Progress – A New Era!***" was completed in February 2014.

<b><u>Participation</u></b>	<b><u>Price</u></b>
<b><i>Specialty Zeolites in Catalysis, 2002-2020: International, Commercial and Technical Progress – A New Era!</i></b>	\$22,500
Report in PDF format, in addition to subscription price	\$1,000

*Immediate access to the 2002 edition of the report, entitled **Specialty Zeolites in Catalysis: 1992-2001**, is available for the nominal fee of \$2,500.*



## ORDER FORM AND SECRECY AGREEMENT

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