World Catalysts

Industry Study with Forecasts to 2005 & 2010

Study #2125 | January 2007 | $5500 | 431 pages
# World Catalysts

## Executive Summary

**Market Environment**

- General .................................................. 4
- World Economic Outlook .................................. 4
- Recent Economic Performance .......................... 5
- Macroeconomic Outlook .................................... 7
- World Population Outlook .................................. 11
- World Manufacturing Outlook .......................... 13
- World Petroleum Refining Outlook .................. 14
- World Polymer Outlook ..................................... 17
- Environmental & Regulatory Outlook .............. 19
- Relationship of per Capita Catalyst Use to per Capita GDP ........... 22
- Catalyst Technology ....................................... 26
- Chemical Synthesis ........................................ 26
- Polymerization .............................................. 29
- Petroleum Refining ......................................... 32
- Pricing ...................................................... 36

## Catalyst Materials

- General .................................................. 39
- Metals ..................................................... 42
- Base Metals .............................................. 44
- Precious Metals .......................................... 47
- Organometallic Materials ................................ 49
- Chemicals .................................................. 51
- Peroxides .................................................. 53
- Acids ....................................................... 54
- Amines & Other Chemicals ............................. 57
- Zeolites .................................................... 59
- Enzymes & Other Materials ............................. 62

## Catalyst Products & Markets

- General .................................................. 65
- Chemical Synthesis Catalysts ......................... 69
- Organic Synthesis Catalysts ............................ 72
- Oxidation Catalysts ....................................... 76
- Synthesis Gas Catalysts .................................. 78
- Hydrogenation Catalysts ................................ 84
- Other Chemical Synthesis Catalysts ............... 87
- Polymerization Catalysts ................................ 89
- Ziegler-Natta Catalysts .................................. 93
- Reaction Initiators ....................................... 95
- Single-Site Catalysts .................................... 98
- Other Polymerization Catalysts .................... 100
- Urethane Catalysts ..................................... 102
- Chromium Catalysts .................................. 103
- Petroleum Refining Catalysts ...................... 104
- Hydroprocessing Catalysts ............................ 107
- Hydrotreating ............................................ 108
- Hydrocracking ........................................... 110

## Other Regions

- Other Regions: Economic Overview ............... 239
- Other Regions: Catalyst Demand ................... 242
- Latin America ............................................. 245
- Brazil ..................................................... 250
- Other Latin America ................................ 256
- Argentina .................................................. 260
- Colombia ................................................... 260
- Venezuela .................................................. 261
- Eastern Europe ........................................... 261
- Russia ...................................................... 267
- Other Eastern Europe .................................. 272
- Poland ..................................................... 277
- Hungary .................................................... 278
- Africa/Mideast ........................................... 278
- Saudi Arabia ............................................. 284
- Other Africa/Mideast ................................ 289
- Iran ......................................................... 294
- Kuwait ...................................................... 294
- Qatar ....................................................... 295
- South Africa ............................................. 295

## Industry Structure

- General .................................................. 297
- Market Share ............................................. 301
- Industry Restructuring ................................ 304
- Cooperative Agreements ............................. 309
- Research & Development ............................. 316
- Marketing & Distribution ............................. 318
- Competitive Strategies ............................... 319

## Company Profiles

- Air Products and Chemicals ......................... 322
- Akzo Nobel NV ........................................ 324
- Albemarle Corporation ............................... 327
- Arkema SA .............................................. 331
- Basell AF SCA .......................................... 334
- BASF AG ................................................. 337
- Bayer AG ............................................... 343
- Borealis AG .......................................... 346
- BP plc ................................................... 348
- Chemtura Corporation ................................ 349
- Chevron Corporation .................................. 351
- Chevron Phillips Chemicals ....................... 354
- Degussa AG ............................................. 356
- Dow Chemical .......................................... 361
- DuPont (EI) de Nemours .............................. 365
- Eastman Chemical ..................................... 368
- Exxon Mobil ............................................ 370
- FMC Corporation ....................................... 372
- General Electric ......................................... 374
- Grace (WR) & Company .............................. 375
- Haldor Topsoe A/S ..................................... 379
- Honeywell International ................................ 382
- INEOS Group ........................................... 386
- Johnson Matthey ....................................... 388
- LANXESS AG ............................................. 392
- Lyondell Chemical ..................................... 394
- Mitsubishi Gas Chemical ............................ 396
- Mitsui Chemicals ....................................... 397
- OM Group ................................................ 400
- PO Corporation .......................................... 402
- Royal Dutch Shell ...................................... 404
- Sued-Chemie AG ....................................... 409
- Total SA .................................................. 414
- Univation Technologies ................................ 415
- Zoom Developers Private Limited ............... 416

For more information, please refer to the PDF document.
List of Tables & Charts

**EXECUTIVE SUMMARY**
1 Summary Table................................. 3

**MARKET ENVIRONMENT**
1 World Gross Domestic Product by Region.. 10
2 World Population by Region............... 12
3 World Manufacturing Value Added
   by Region.................................. 14
4 World Refined Petroleum Product
   Output by Region.......................... 17
5 World Polymer Production................... 19
Ch1 Catalyst Use per Capita/GDP
   per Capita Relationship, 2005........... 25
6 Chemical Synthesis Processes.......... 29
7 Polymers & Polymerization Processes.... 32
8 Petroleum Refining Processes........... 35

**CATALYST MATERIALS**
1 World Catalyst Demand by Material........ 41
Ch1 World Catalyst Demand by Material, 2005.. 42
2 World Metal Catalyst Demand.............. 44
3 World Base Metal Catalyst Demand........ 46
4 World Precious Metal Catalyst Demand.... 49
5 World Organometallic Catalyst Demand.... 51
6 World Chemical Catalyst Demand........... 52
7 World Peroxide Catalyst Demand.......... 54
8 World Acid Catalyst Demand................ 57
9 World Amine & Other Chemical
   Catalyst Demand.......................... 59
10 World Zeolite Catalyst Demand.......... 61
11 World Enzyme & Other
   Catalyst Demand.......................... 64

**CATALYST PRODUCTS & MARKETS**
1 World Catalyst Demand by Market.......... 68
Ch1 World Catalyst Demand by Market, 2005. 68
2 World Chemical Synthesis
   Catalyst Demand.......................... 71
Ch1 World Chemical Synthesis Catalyst
   Demand by Type, 2005................... 72
3 World Organic Synthesis
   Catalyst Demand.......................... 76
4 World Oxidation Catalyst Demand........ 79
5 World Synthesis Gas Catalyst Demand..... 81
6 World Hydrogenation Catalyst Demand.... 87
7 World Other Chemical Synthesis
   Catalyst Demand.......................... 89
8 World Polymerization Catalyst Demand... 92
Ch1 World Polymerization Catalyst
   Demand by Type, 2005................... 93
9 World Ziegler-Natta Catalyst Demand..... 95
10 World Reaction Initiator Catalyst Demand 97
11 World Single-Site Catalyst Demand...... 100
12 World Other Polymerization
   Catalyst Demand.......................... 101
13 World Petroleum Refining
   Catalyst Demand.......................... 106
Ch1 World Petroleum Refining Catalyst
   Demand by Type, 2005................... 107
14 World Hydrosprocessing Catalyst Demand 108
15 World Fluid Catalytic Cracking
   Catalyst Demand.......................... 114
16 World Alkylation Catalyst Demand....... 117
17 World Reforming & Other Petroleum
   Refining Catalyst Demand............... 120
18 World Catalyst Demand by Region......... 124
Ch1 World Catalyst Demand by Region, 2005 124

**NORTH AMERICA**
1 North America Macroeconomic
   Indicators.................................. 126
2 North America Catalyst Demand............ 128
Ch1 North America Catalyst Demand, 2005.. 129
3 United States Macroeconomic
   Indicators.................................. 132
4 United States Catalyst Demand............ 135
5 Canada Macroeconomic Indicators......... 138
6 Canada Catalyst Demand................... 140
7 Mexico MacroeconomicIndicators.......... 143
8 Mexico Catalyst Demand.................... 146

**WESTERN EUROPE**
1 Western Europe Macroeconomic
   Indicators.................................. 149
2 Western Europe Catalyst Demand.......... 151
Ch1 Western Europe Catalyst Demand, 2005.. 152
3 Germany Macroeconomic Indicators........ 154
4 Germany Catalyst Demand.................. 157
5 France Macroeconomic Indicators......... 160
6 France Catalyst Demand.................... 162
7 United Kingdom Macroeconomic
   Indicators.................................. 165
8 United Kingdom Catalyst Demand.......... 167
9 Italy Macroeconomic Indicators........... 169
10 Italy Catalyst Demand..................... 171
11 Belgium Macroeconomic Indicators....... 174
12 Belgium Catalyst Demand.................. 176
13 Netherlands Macroeconomic
   Indicators.................................. 178
14 Netherlands Catalyst Demand............... 181
15 Spain Macroeconomic Indicators.......... 183
16 Spain Catalyst Demand..................... 185
17 Other Western Europe
   Macroeconomic Indicators............... 187
18 Other Western Europe
   Catalyst Demand.......................... 189

**ASIA/PACIFIC**
1 Asia/Pacific Macroeconomic Indicators... 193
2 Asia/Pacific Catalyst Demand.............. 196
Ch1 Asia/Pacific Catalyst Demand, 2005.... 197
3 Japan Macroeconomic Indicators.......... 200
4 Japan Catalyst Demand..................... 203
5 China Macroeconomic Indicators.......... 207
6 China Catalyst Demand..................... 211
7 South Korea Macroeconomic Indicators... 214
8 South Korea Catalyst Demand............... 217
9 India Macroeconomic Indicators.......... 220
10 India Catalyst Demand..................... 223
11 Taiwan Macroeconomic Indicators........ 226
12 Taiwan Catalyst Demand................... 228
13 Other Asia/Pacific Macroeconomic
   Indicators.................................. 231
14 Other Asia/Pacific Catalyst Demand...... 234

**OTHER REGIONS**
1 Other Regions Macroeconomic
   Indicators.................................. 242
2 Other Regions Catalyst Demand............ 244
Ch1 Other Regions Catalyst Demand, 2005.. 245
3 Latin America Macroeconomic
   Indicators.................................. 248
4 Latin America Catalyst Demand............ 250
5 Brazil Macroeconomic Indicators......... 253
6 Brazil Catalyst Demand..................... 255
7 Other Latin America Macroeconomic
   Indicators.................................. 258
8 Other Latin America Catalyst Demand..... 259
9 Eastern Europe Macroeconomic
   Indicators.................................. 264
10 Eastern Europe Catalyst Demand.......... 267
11 Russia Macroeconomic Indicators........ 270
12 Russia Catalyst Demand................... 272
13 Other Eastern Europe Macroeconomic
   Indicators.................................. 275
14 Other Eastern Europe Catalyst Demand... 276
15 Africa/Mideast Macroeconomic
   Indicators.................................. 282
16 Africa/Mideast Catalyst Demand.......... 284
17 Saudi Arabia Macroeconomic Indicators . 287
18 Saudi Arabia Catalyst Demand............ 289
19 Other Africa/Mideast Macroeconomic
   Indicators.................................. 291
20 Other Africa/Mideast Catalyst Demand... 293

**INDUSTRY STRUCTURE**
1 World Catalyst Sales by Company, 2005.. 299
Ch1 World Catalyst Market Share, 2005...... 303
2 Selected Acquisitions & Divestitures..... 306
3 Selected Cooperative Agreements......... 311
Single-site catalysts will achieve double digit gains as they find greater acceptance in polymer capacity additions, especially in the Mideast where natural gas-rich nations are expanding their polymer capacity.

World demand to rise 3.6% annually through 2010

World catalyst demand will rise 3.6 percent per year to $12.3 billion in 2010, aided by a healthy world economy, and growing demand by the chemical, polymer and refining industries for more energy efficient processes and products. After experiencing robust growth in recent years due to rapidly rising prices, catalyst demand will moderate in the near term due to falling raw material and energy costs. Further out, growth will accelerate as prices rise again and companies continue to move to newer, higher-value and energy efficient products.

Polymerization catalysts to grow the fastest

Reflecting continued strong growth in polymer demand and production, polymer catalysts will experience the fastest gains. Single-site catalysts will achieve double digit advances as they find greater acceptance in new capacity additions, particularly in the Mideast where natural gas-rich nations such as Iran and Saudi Arabia are rapidly expanding their polymer capacity. Other polymerization catalysts, such as the more traditional Ziegler-Natta catalysts, will also achieve strong gains, as their established track record continues to make them attractive options, particularly at existing plants.

Refining catalyst growth will be aided by strong volume gains and a continued improvement in prices for fluid catalytic cracking catalysts. However, the return of sulfuric acid prices in North America closer to historical levels will prevent even faster advances. Slower gains in North America and Western Europe will be offset by rapid growth in Asia and other developing regions as rising per capita incomes boost gasoline demand, and as developing countries begin imposing stricter sulfur regulations to fight air pollution.

Organometallics to lead gains by material

Weakness in Western Europe will be offset by expanding production in China and India, and rapid growth in the Africa/Mideast region where basic organic and petrochemical production account for a greater share of chemical output.

Copyright 2007 The Freedonia Group, Inc.
COMPANY PROFILES

Air Products and Chemicals Incorporated
7201 Hamilton Boulevard
Allentown, PA 18195
610-481-4911
http://www.airproducts.com

Sales: $8.9 billion (FY 2006), $8.1 billion (FY 2005)
Geographic Sales: (FY 2005, as percent of total) US 50%; Europe 29%; Asia and Latin America 15%; Canada and the Rest of the World 6%
Employment: 20,200 (FY 2005)

Key Products: metal-based and amine-type polyurethane catalysts


The Company participates in the world catalyst industry through the Chemicals segment, which had FY 2006 sales of $908 million. Included in the operations of this segment is Air Products' Polyurethane Additives business, which produces and supplies a broad range of catalysts and surfactants, as well as prepolymers and curatives, used in the manufacture of polyurethane foams, coatings, adhesives and sealants. Among these offerings are various metal-based catalysts marketed under the DABCO and POLYCAT brand names.

322


**OTHER REGIONS**

**Saudi Arabia: Catalyst Demand**

Saudi Arabia is a major producer of crude petroleum and years has moved aggressively to complement its crude oil production with related downstream activities. The petrochemical and related petroleum products industries in Saudi Arabia, utilizing a variety of refining technologies, have remained small. Saudi Arabia has been boosting its hydroprocessing capacity, as most of the country’s oil is sour -- that is, it contains high levels of sulfur that must be removed before the distillates can be upgraded to more valuable motor fuels for the export market.

SABIC is a state-owned conglomerate engaged in the production of petrochemicals and polymers. SABIC has led the way in expanding polymer production capacity, either through its own facilities or joint ventures. Many of the new facilities will use advanced catalyst technologies sourced from foreign countries, particularly because the chemicals being produced are made using well-established processes that have already been extensively optimized. For example, Haldor Topsoe has a contract with Mitsubishi Heavy Industries to supply Topsoe’s two-step reforming technology for a new world-scale methanol plant in Al-jubail, Saudi Arabia. The methanol plant is being built by AR-RAZI, a 50/50 joint venture between SABIC and a Japanese consortium led by Mitsubishi Gas Chemical.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Domestic Product (bil 2000$)</td>
<td>212</td>
<td>241</td>
<td>293</td>
<td>357</td>
<td>423</td>
</tr>
<tr>
<td>metric tons catalyst/bil $ GDP</td>
<td>42.5</td>
<td>49.8</td>
<td>58.0</td>
<td>70.0</td>
<td>82.7</td>
</tr>
<tr>
<td>Catalyst Demand (000 metric tons)</td>
<td>9</td>
<td>12</td>
<td>17</td>
<td>25</td>
<td>35</td>
</tr>
<tr>
<td>$/metric ton</td>
<td>5000</td>
<td>5835</td>
<td>8825</td>
<td>9200</td>
<td>10700</td>
</tr>
<tr>
<td>Catalyst Demand</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refining Catalysts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Polymerization Catalysts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemical Synthesis Catalysts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Saudi Arabia</td>
<td>20.9</td>
<td>23.9</td>
<td>29.0</td>
<td>28.2</td>
<td>27.4</td>
</tr>
<tr>
<td>Africa/Mideast Catalyst Demand</td>
<td>215</td>
<td>293</td>
<td>517</td>
<td>815</td>
<td>1370</td>
</tr>
</tbody>
</table>

“Catalyst demand in Saudi Arabia will advance at a rapid 8.9 percent annual pace to $230 million, or 25,000 metric tons, in 2010. The strongest gains -- nearly twelve percent per year -- will be in ...”

--Section VII, pg. 287
Order Information

Five Convenient Ways to Order

ONLINE: www.freedoniagroup.com
MAIL: Print out and complete the order form and send to The Freedonia Group (see address at the bottom of this form)
PHONE: Call toll free, 800.927.5900 (US) or +1 440.684.9600
FAX: +1 440.646.0484 (US)
EMAIL: info@freedoniagroup.com

Free Handling & Shipping
There is NO charge for handling or UPS shipping in the US. Expect delivery in 3 to 5 business days. Outside the US, Freedonia provides free airmail service. Express delivery is available at cost.

Orders Outside of the US
Checks must be made payable in US funds, drawn against a US bank and mailed directly to The Freedonia Group. For wire transfers please contact our customer service department at info@freedoniagroup.com. Credit cards accepted.

Corporate Use License
Now every decision maker in your organization can act on the key intelligence found in all Freedonia studies. For an additional $2300, companies receive unlimited use of an electronic version (PDF) of the study. Place it on your intranet, e-mail it to coworkers around the world, or print it as many times as you like.

Click here to learn more about the Corporate Use License

Order Form

World Catalysts .............................................................. $5500

☐ Corporate Use License (add to study price) * + $2300
☐ Additional Print Copies @ $500 each *

Total (including selected option) $

☐ Enclosed is my check (5% discount) drawn on a US bank and payable to The Freedonia Group, Inc., in US funds (Ohio residents add 7.75% sales tax)

☐ Bill my company ☐ American Express ☐ MasterCard ☐ Visa

Credit Card #

MM YY

Expiration

Name ____________________________
Title ____________________________
Company ________________________
Division _________________________
Street ____________________________ (No PO Box please)
City/State/Zip ____________________
Country _________________________
Phone ____________________________ Fax _______________________
Email ____________________________

Signature ________________________

☐ Individual Use License Agreement
The undersigned hereby represents that the above captioned study will be used by only ___ individual(s) who are employees of the company and that the study will not be loaded on a network for multiple users. In the event that usage of the study changes, the Company will promptly notify Freedonia of such change and will pay to Freedonia the appropriate fee based on Freedonia’s standard fee schedule then in effect. Note: Entire company corporate use license, add $2300; one additional user, add $500; two additional users, add $1000; three additional users, add $1500.

☐ Corporate Use License Agreement
The above captioned study may be stored on the company’s intranet or shared directory, available to company employees. Copies of the study may be made, but the undersigned represents that distribution of the study will be limited to employees of the company.

Signature ________________________

* Please check appropriate option and sign below to order an electronic version of the study.

Save 15%
If you order three (3) different titles at the same time, you can receive a 15% discount. If your order is accompanied by a check or wire transfer, you may take a 5% cash discount (discounts do not apply to Corporate Use Licenses).
About The Freedonia Group

The Freedonia Group, Inc., is a leading international industry market research company that provides its clients with information and analysis needed to make informed strategic decisions for their businesses. Studies help clients identify business opportunities, develop strategies, make investment decisions and evaluate opportunities and threats. Freedonia research is designed to deliver unbiased views and reliable outlooks to assist clients in making the right decisions. Freedonia capitalizes on the resources of its proprietary in-house research team of experienced economists, professional analysts, industry researchers and editorial groups. Freedonia covers a diverse group of industries throughout the United States, the emerging China market, and other world markets. Industries analyzed by Freedonia include:

- Chemicals • Plastics • Life Sciences • Packaging • Building Materials • Security & Electronics • Industrial Components & Equipment • Automotive & Transportation Equipment • Household Goods • Energy/Power Equipment

Freedonia Custom Research

Freedonia Custom Research delivers the same high quality, thorough and unbiased assessment of an industry or market as an industry study. Since the research initiative is based upon a company’s specific needs, companies harness Freedonia’s research capabilities and resources to answer unique questions. When you leverage the results of a Freedonia Custom Research engagement, you are able to obtain important answers to specific questions and issues associated with: mergers and acquisitions, new product launches/development, geographic expansion, entry into new markets, strategic business planning, and investment and funding decisions.

Freedonia Custom Research is ideal for companies seeking to make a strategic difference in the status quo and focus on future business growth. Working side by side with clients, Freedonia’s team is able to define a research project that is custom-tailored to answer specific questions and provide the basis from which a company can make informed business decisions.