World Well Stimulation Materials

Industry Study with Forecasts to 2010 & 2015

Study #2161 | March 2007 | $5400 | 230 pages
# Table of Contents

## EXECUTIVE SUMMARY

**MARKET ENVIRONMENT**

General ........................................ 4  
World Economic Overview .................... 5  
Recent Historical Trends ..................... 5  
Macroeconomic Outlook ...................... 8  
World Demographic Outlook ................. 11  
World Manufacturing Outlook ............... 13  
World Petroleum Outlook .................... 15  
Reserves & Exploration ...................... 18  
Crude Oil Pricing Patterns .................. 19  
World Natural Gas Outlook ................. 22  
Reserves & Exploration ...................... 23  
Production .................................... 25  
Natural Gas Pricing Patterns ............... 27  
Oilfield Services Indicators ............... 29  

## TECHNOLOGY

General ........................................ 32  
Well Drilling & Completion ................. 34  
Horizontal Drilling ......................... 35  
Multilateral Drilling ....................... 36  
Coiled Tubing Drilling ...................... 38  
Underbalanced Drilling ..................... 38  
Well Completion ................................ 39  
Well Stimulation Technologies ............. 40  
Hydraulic Fracturing ....................... 41  
Acidizing ..................................... 43  
Fracture Acidizing ......................... 48  
Other Well Stimulation Technologies ...... 49  
Well Stimulation Fluids .................... 52  
Fracturing Fluids .......................... 52  
Foamed Fracturing Fluids ................. 55  
Acidizing Fluids ............................ 56  
Foamed Acidizing Fluids ................... 56  
Seismology .................................. 57  

## WORLD OVERVIEW

General ........................................ 58  
Product Overview ............................. 60  
Proppants Demand ............................ 61  
Ceramic Proppants ......................... 63  
Sand & Other Proppants .................... 65  
Proppants Demand by Country .......... 69  
Base Fluid Materials Demand .............. 70  
Gelling Agents ................................ 71  
Foaming Agents ............................. 72  
Acids........................................... 74  
Crosslinking Agents ....................... 75  
Other Base Fluid Materials ............... 75  
Base Fluid Materials Demand by Country 77  
Additives Demand ......................... 78  
Breakers ..................................... 80  
Friction Reducers ......................... 82  
Fluid Loss Control Agents ............... 82  
Nonemulsifiers ............................. 83  
Biocides ..................................... 84  
Corrosion Inhibitors ....................... 85  
Other Additives ............................. 86  
Additives Demand by Country ............. 88  

## KEY COUNTRIES

United States .................................. 90  
Russia .......................................... 103  
Canada ......................................... 114  
China ........................................... 123  

## OTHER REGIONS

Latin America ................................ 133  
Europe ......................................... 139  
Asia/Pacific .................................. 147  
Africa/Mideast ................................ 152  

## INDUSTRY STRUCTURE

General ........................................ 157  
Market Share & Industry .................... 157  
Composition .................................. 160  
Mergers & Acquisitions ..................... 163  
Cooperative Agreements .................... 164  
Marketing & Distribution .................. 168  
Research & Development ................... 171  
Competitive Strategies .................... 172  

## COMPANY PROFILES

Akzo Nobel .................................. 175  
Albemarle Corporation ...................... 176  
Badger Mining ................................ 178  
Baker Hughes ................................ 179  
BASF AG ....................................... 181  
BJ Services ................................... 182  
CARBO Ceramics Incorporated .......... 186  
Champion Technologies .................... 188  
Chevron Phillips Chemical ................. 189  
Cognis Deutschland ......................... 191  
Dow Chemical Company .................... 192  
DuPont (EI) de Nemours ..................... 194  
Enerchem International ..................... 196  
Fairmount Minerals ......................... 197  
FMC Corporation ............................ 199  
Guizhou LinHai New Material Manufacturing Company ...... 200  
Halliburton Company ....................... 201  
Hercules Incorporated ..................... 203  
Hexion Specialty Chemicals ............. 205  
JSC Borovichi Refractories Plant .......... 206  
Metro Engineering and Contracting ....... 207  
Mineração Curimbatá Limitada ............ 207  
Navdeep Chemicals ......................... 208  
Praxair Incorporated ....................... 209  
PT Tesso Tetra Chemika .................... 210  
Rhodia SA ..................................... 211  
Saint-Gobain ................................ 214  
Schlumberger Limited ....................... 216  
Smith International ......................... 220  
Trekhgorny Ceramic Factory .............. 223  
Unimin Corporation ......................... 223  
US Silica Company ......................... 224  
Yixing Orient Petroleum Proppant ....... 225  
Other Companies Mentioned in Study .. 226
List of Tables/Charts

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

MARKET ENVIRONMENT
1 World Gross Domestic Product by Region............................ 11
2 World Population by Region ....... 13
3 World Manufacturing Value Added by Region .......... 14
4 World Proven Oil Reserves by Region, 2005 .................... 17
5 World Crude Oil Production by Country............................ 19
6 World Proven Natural Gas Reserves by Region, 2005 .......... 24
7 World Natural Gas Production by Country ....................... 27
8 World Average Annual Spot Crude Prices, 1995-2005 .......... 22
9 World Proven Natural Gas Prices, 1995-2005 ................. 28
10 World Oilfield Service Indicators . 31

WORLD OVERVIEW
1 World Well Stimulation Materials Demand ...................... 60
2 World Well Stimulation Materials Demand by Product ........ 61
3 World Proppants Demand by Type................................. 63
4 World Proppants Demand by Country.............................. 70
5 World Well Stimulation Base Fluid Materials Demand by Type ... 71
6 World Well Stimulation Base Fluid Materials Demand by Country ... 78
7 World Well Stimulation Additives Demand by Type ............. 80
8 World Well Stimulation Additives Demand by Country ........ 89

KEY COUNTRIES
1 United States -- Key Indicators for Well Stimulation Materials ...... 93
2 United States -- Well Stimulation Materials Demand ................ 97
3 United States -- Proppants Demand .................................. 99
4 United States -- Well Stimulation Fluids & Additives Demand ......... 103
5 Russia -- Key Indicators for Well Stimulation Materials .......... 107
6 Russia -- Well Stimulation Materials Demand ...................... 110
7 Russia -- Proppants Demand ........................................ 112
8 Russia -- Well Stimulation Fluids & Additives Demand ............ 114
9 Canada -- Key Indicators for Well Stimulation Materials .......... 117
10 Canada -- Well Stimulation Materials Demand .................... 119
11 Canada -- Proppants Demand ..................................... 121
12 Canada -- Well Stimulation Fluids & Additives Demand .......... 123
13 China -- Key Indicators for Well Stimulation Materials .......... 128
14 China -- Well Stimulation Materials Demand ..................... 129
15 China -- Proppants Demand ...................................... 131
16 China -- Well Stimulation Fluids & Additives Demand ............ 132

OTHER REGIONS
1 Latin America -- Key Indicators for Well Stimulation Materials ...... 136
2 Latin America -- Well Stimulation Materials Demand by Type ........ 138
3 Latin America -- Well Stimulation Materials Demand by Country .... 139
4 Europe -- Key Indicators for Well Stimulation Materials .......... 144
5 Europe -- Well Stimulation Materials Demand by Type .......... 145
6 Europe -- Well Stimulation Materials Demand by Area .......... 146
7 Asia/Pacific -- Key Indicators for Well Stimulation Materials ....... 150
8 Asia/Pacific -- Well Stimulation Materials Demand by Type ........ 151
9 Asia/Pacific -- Well Stimulation Materials Demand by Country ... 152
10 Africa/Mideast -- Key Indicators for Well Stimulation Materials .... 155
11 Africa/Mideast -- Well Stimulation Materials Demand by Type .... 156
Cht World Well Stimulation Materials Market Share, 2005 .......... 162

INDUSTRY STRUCTURE
1 Selected Acquisitions & Divestitures .................. 164
2 Selected Cooperative Agreements ..................... 166
High oil and gas prices have enabled and motivated major producers to raise oil and gas well production by increasing exploration and increasing use of well stimulation techniques.

**World demand to rise 11.3% annually through 2010**

World demand for well stimulation materials is projected to increase 11.3 percent per year through 2010 to $4.2 billion. High oil and gas prices over much of the 2002-2006 period have enabled and motivated major producers to raise production of crude oil and natural gas. This has been accomplished by increasing exploration and increasing use of well stimulation techniques. Stimulation needs are expanding most significantly in countries where existing reserves are depleting at a rapid pace.

**Market leaders to grow at double-digit annual rates**

Demand in the US by itself represented 58 percent of the global market for well stimulation materials in 2005. Despite having a more mature market, US sales of well stimulation materials will still register gains of close to eleven percent per year through 2010. Growth will be spurred by increasingly mature oil and gas wells in the country combined with rising exploration and drilling activity in challenging environments -- requiring deeper drilling and often the use of more expensive well stimulation materials.

Over the past decade, Russia has become the second largest market for well stimulation materials, and is projected to increase 12.0 percent per year through 2010. Holding by far the world’s largest natural gas reserves, Russia has significant gas related exploration and drilling activity. Russia also possesses the world’s seventh largest crude oil reserves and is currently the world’s second largest crude oil producer behind Saudi Arabia. Russian oil and gas producers have become highly receptive to the use of well stimulation materials as a result of technology transfer from Western oilfield services companies.

Demand in Canada, the third largest national market for well stimulation materials, is projected to grow 12.7 percent per year through 2010 to $470 million. The number of well completions in Canada in 2004 and in 2005 set consecutive all-time records, and future growth in drilling and exploration activity is expected to remain strong. Of particular importance is rapid ongoing coal bed methane (CBM) and tight gas well development.

**China to see fastest gains among top four markets**

Of the four leading nations, demand for well stimulation materials holds strongest growth prospects in China. To maintain its rapid pace of economic development and industrialization, China is increasingly focusing on improving energy security from both external and internal supplies. Western well stimulation material producing companies continue to set up production sites in China to serve the booming domestic market.

---

**United States** 56%

**Russia** 13%

**Canada** 11%

**China** 6%

**Other Countries** 14%

---

Photo courtesy of Crown Energy Technologies
North America

Of local consumption is met through imports from CARBO Ceramics (US). However, in February 2005, CARBO’s patent on its propellant expired and imports from China are now rising. Prior to the patent expiration, CARBO had successfully filed a case against China Ceramics (Canada), which sold ceramic proppants in Canada by importing them from Guizhou LinHai New Material in China. In the aftermath of the patent expiration, smaller local producers are also manufacturing ceramic proppants. For example, Global SynFrac is finalizing commencement of production for its unique line of lightweight SPHERELITE proppant products. Trican has already preordered 7,500 metric tons of the new product.

Demand for sand and other proppants (the vast majority being sand) in Canada is projected to rise 13.6 percent per year to US$170 million in 2010. Although a majority of sand proppants used by the Canadian oil and gas industry are imported from US-based companies such as Badger Mining, a number of domestic producers are also important. Locally based Metro Engineering and Contracting (via its Canfrac Sands subsidiary) manufactures 20/40 mesh fracturing sand for use in conventional oil and gas well fracturing operations in the Western Canadian Sedimentary Basin. Canfrac’s sand deposits and processing facilities are located near Lloydminster, Saskatchewan, and it also exports to the US.

Another local producer, Winn Bay Sands, manufactures premium white fracturing sands from sandstone at Hanson Lake in Saskatchewan. The company sells its products in southern Alberta, Canada, and in the northern US. Recently, Winn Bay established a rail trans-loading facility capable of shipping sand proppants by rail to anywhere in North America. In 2006, Hexion Specialty Chemicals (US) opened a plant in Alberta, Canada that produces resin-coated sand proppants for the Canadian oil and gas industry. The site had a production capacity of 68,250 metric tons of proppants in 2006.

Table V-12

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Well Stimulation Materials</td>
<td>33</td>
<td>126</td>
<td>258</td>
<td>470</td>
<td>765</td>
</tr>
<tr>
<td>% fluids &amp; additives</td>
<td>60.6</td>
<td>56.3</td>
<td>53.5</td>
<td>47.9</td>
<td>45.8</td>
</tr>
</tbody>
</table>

Fluids & Additives Demand

Base Fluid Materials:
- Gelling Agents
- Foaming Agents
- Acids
- Crosslinking Agents
- Other
Additives:
- Breakers
- Friction Reducers
- Fluid Loss Control Agents
- Nonemulsifiers
- Biocides
- Corrosion Inhibitors
- Other Additives

Chart VII-1

World Well Stimulation Materials Market Share, 2005 ($2.5 billion)
Sample Profile, Tables & Forecast

COMPANY PROFILES

Badger Mining Corporation
409 South Church Street
Berlin, WI 54923
920-361-2388
http://www.badgerminingcorp.com

Annual Sales: $50 million (company would not verify, 1/07)
Employment: 190 (verified by company, 1/07)
Key Products: hydraulic fracturing sand proppants

Badger Mining is an international producer of industrial silica sand, limestone, zeolite and other mineral aggregates. These materials are used primarily to serve the industrial, environmental and recreational markets, for such applications as hydraulic fracturing, gravel packing, water filtration and sewage treatment. Operations for the privately held company include three wholly owned subsidiaries: Ash Meadows LLC, LogicHaul LLC and Badger Mining Poland Limited.

The Company is active in the world well stimulation materials industry through the manufacture of industrial sands used as proppants in well stimulation applications. For the oil and gas industry, Badger Mining supplies BADGER FRAC hydraulic fracturing sands, which include Ottawa-type, Northern White raw fracturing sands ranging in mesh size from 12/20 to 70/140. According to Badger Mining, BADGER FRAC natural proppants provide high quality, consistency and long-term conductivity properties without the high costs associated with synthetic proppants.

Badger Mining produces BADGER FRAC hydraulic fracturing sand proppants at sites in Taylor and Fairwater, Wisconsin. The Taylor facility, which produces about 728,000 metric tons of sand annually,

TABLE V-10
CANADA -- WELL STIMULATION MATERIALS DEMAND
(million US dollars)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Producing Oil Wells (000)</td>
<td>46.0</td>
<td>53.3</td>
<td>59.0</td>
<td>66.0</td>
<td>72.0</td>
</tr>
<tr>
<td>$000 materials/well</td>
<td>0.7</td>
<td>2.4</td>
<td>4.4</td>
<td>7.1</td>
<td>10.6</td>
</tr>
<tr>
<td>Well Stimulation Materials Demand</td>
<td>33</td>
<td>126</td>
<td>258</td>
<td>470</td>
<td>765</td>
</tr>
<tr>
<td>Base Fluid Materials</td>
<td>10</td>
<td>42</td>
<td>85</td>
<td>140</td>
<td>220</td>
</tr>
<tr>
<td>Additives</td>
<td>10</td>
<td>29</td>
<td>53</td>
<td>85</td>
<td>130</td>
</tr>
<tr>
<td>Proppants</td>
<td>13</td>
<td>55</td>
<td>120</td>
<td>245</td>
<td>415</td>
</tr>
</tbody>
</table>

Through 2010, demand for proppants in Canada is projected to rise 15.3 percent per year to US$245 million. Increasing drilling activity and receptiveness to hydraulic fracturing will spur this growth. Gas and proppant-based CBM well fracturing also holds strong potential for growth, albeit from a negligible base."

--Section V, pg. 119

TABLE V-11
CANADA -- PROPPANTS DEMAND
(million US dollars)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Well Stimulation Materials</td>
<td>33</td>
<td>126</td>
<td>258</td>
<td>470</td>
<td>765</td>
</tr>
<tr>
<td>% proppants</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proppants Demand</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ceramic Proppants</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sand &amp; Other Proppants</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 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.

### Order Form

<table>
<thead>
<tr>
<th>World Well Stimulation Materials</th>
<th>$5400</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Corporate Use License</strong> <em>(add to study price)</em></td>
<td>+ $2300</td>
</tr>
<tr>
<td><strong>Additional Print Copies @ $500 each</strong> *</td>
<td>Total (including selected option) $</td>
</tr>
<tr>
<td>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)</td>
<td></td>
</tr>
<tr>
<td><strong>Bill my company</strong></td>
<td><strong>American Express</strong></td>
</tr>
<tr>
<td>Credit Card #</td>
<td>Expiration MM YY</td>
</tr>
<tr>
<td>Name</td>
<td>Title</td>
</tr>
<tr>
<td>Company</td>
<td>Division</td>
</tr>
<tr>
<td>Street</td>
<td>City/State/Zip</td>
</tr>
<tr>
<td>Phone</td>
<td>Fax</td>
</tr>
<tr>
<td>Email</td>
<td></td>
</tr>
</tbody>
</table>

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

### 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 $400; two additional users, add $800; three additional users, add $1200.

### 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

World Catalysts

The world catalyst market will reach $12.3 billion in 2010, driven by growing demand in the chemical, polymer and refining industries for more energy efficient processes and products. Polymer catalysts will grow the fastest while chemical synthesis types will remain dominant. Organometallics will lead gains by material. This study analyzes the global catalyst industry to 2010 and 2015 by material, product, market, world region and for 18 countries. It also evaluates market share and profiles industry participants.

#2155 ................. 01/2007 ................. $5500

Well Stimulation Materials

US well stimulation material demand will grow 11% annually through 2010. Gains will be driven by efforts to maximize output of existing oil and gas wells and by increases in well drilling and completion. Proppants will remain the largest type and grow the fastest, followed by foaming and gelling agents and base fluid additives. This study analyzes the $1.1 billion US well stimulation material industry to 2010 and 2015 by product and regional market. The study also details market share and profiles major players.

#2101 ................. 09/2006 ................. $4200

Lubricants

US lubricant demand will reverse recent declines through 2010. Increased manufacturing activity will fuel demand for process oils, hydraulic fluids and greases; a bigger motor vehicle park will benefit engine oils and transmission fluids. Environmental concerns will favor bio-based lubricants and re-refined basestocks. Process oils will lead gains. This study analyzes the $11.2 billion US lubricant industry to 2010 and 2015 by product and market. It also evaluates market share and profiles major players.

#2097 ................. 08/2006 ................. $4400

Refinery Chemicals

Demand for refinery chemicals in the US will grow 5.6% annually through 2010. Gains will be driven by refineries’ use of more chemically-intensive conversions to boost yields and higher levels of treatment to remove impurities. Hydrocracking and hydrotreating applications will grow the fastest, followed by water treatment. This study analyzes the $2.7 billion US refinery chemical industry to 2010 and 2015 by application and product. It also evaluates company market share and profiles leading industry players.

#2065 ................. 06/2006 ................. $4200

Industrial Gases

US industrial gas demand will grow 3.6% annually through 2010. Best opportunities will remain in the key petroleum and natural gas market while faster growth will occur in smaller volume uses such as electronics and healthcare. Hydrogen will continue as the fastest growing gas in value terms, and will stay the most valuable market. This study analyzes the $8.4 billion US industrial gas industry to 2010 and 2015 by type, delivery method and market. It also details market share and profiles major players.

#2149 ................. 02/2007 ................. $4400

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.