Engineering Plastics

Industry Study with Forecasts for 2019 & 2024

Study #3242 | April 2015 | $5300 | 321 pages
Table of Contents

EXECUTIVE SUMMARY

MARKET ENVIRONMENT
General ................................................................. 4
Macroeconomic Outlook ........................................ 4
Consumer Spending Patterns ................................. 9
Manufacturing Outlook .......................................... 11
Electrical & Electronics Outlook ............................ 15
Electronic & Computer Equipment ......................... 17
Appliances ........................................................... 21
Building Construction Trends ................................. 23
Motor Vehicle Trends ........................................... 25
Plastic Resin Outlook ........................................... 28
Competitive Materials ........................................... 30
Historical Market Trends ........................................ 33
Pricing Trends ....................................................... 36
Regulatory & Environmental Issues ....................... 38
Recycling Activity ................................................ 41
Foreign Trade ...................................................... 44
International Activity ........................................... 46

RESINS
General ............................................................... 49
Nylon .................................................................... 53
Markets ............................................................... 55
Motor Vehicles .................................................... 57
Electrical & Electronic ......................................... 59
Medical & Consumer .......................................... 61
Industrial ............................................................ 63
Packaging ............................................................ 64
Construction & Other .......................................... 65
Producers & Capacity .......................................... 65

Acrylonitrile-Butadiene-Styrene ......................... 68
Markets ............................................................... 71
Electrical & Electronic ......................................... 73
Motor Vehicles .................................................... 75
Construction ........................................................ 77
Medical & Consumer .......................................... 79
Industrial & Other .............................................. 80
Producers & Capacity .......................................... 82

Polycarbonate ..................................................... 84
Markets ............................................................... 86
Electrical & Electronic ......................................... 88
Medical & Consumer .......................................... 90
Motor Vehicles .................................................... 92
Construction ........................................................ 94
Industrial & Other .............................................. 96
Producers & Capacity .......................................... 97

Thermoplastic Polyesters .................................. 99

Polybutylene Terephthalate ................................. 101
Polyethylene Terephthalate ................................. 103
Liquid Crystal Polymers & Other ......................... 104

Motor Vehicles .................................................... 108
Electrical & Electronic ........................................ 110
Medical & Consumer .......................................... 111
Other Markets .................................................... 112

Polyacetal ............................................................ 113
Markets ............................................................... 115
Motor Vehicles .................................................... 116
Industrial ............................................................ 117
Electrical & Electronic ........................................ 117
Other Markets .................................................... 118
Producers & Capacity .......................................... 119

Fluoropolymers .................................................... 120
Polytetrafluoroethylene .................................... 122
Polyvinylidene Fluoride .................................... 124
Fluorinated Ethylene Propylene .......................... 125
Other Fluoropolymers ........................................ 127
Markets ............................................................... 130
Industrial ............................................................ 131
Electrical & Electronic ........................................ 132
Medical & Consumer .......................................... 135
Other Markets .................................................... 136
Producers ............................................................ 136

Polyphenylene Oxide .......................................... 138
Markets ............................................................... 140
Motor Vehicles .................................................... 142
Electrical & Electronic ........................................ 143
Other Markets .................................................... 143
Producers ............................................................ 144

Sulfone Polymers .................................................. 144
Markets ............................................................... 147
Medical & Consumer .......................................... 147
Electrical & Electronic ........................................ 148
Industrial ............................................................ 149
Other Markets .................................................... 149
Producers ............................................................ 150

Polyphenylene Sulfide ........................................ 150
Markets ............................................................... 152
Motor Vehicles .................................................... 153
Electrical & Electronic ........................................ 154
Other Markets .................................................... 154
Producers & Capacity .......................................... 155

Polymides ........................................................... 157
Markets ............................................................... 159
Motor Vehicles .................................................... 160
Electrical & Electronic ........................................ 161
Other Markets .................................................... 161
Producers ............................................................ 162
Other Resins ....................................................... 162
Polyetherketones ............................................... 163
All Other Resins ................................................ 165

MARKETS
General ............................................................... 167
Motor Vehicles .................................................... 169

Engine & Mechanical .......................................... 172
Interior ............................................................... 173
Structural & Exterior .......................................... 175
Resins ................................................................. 177
Electrical & Electronic ........................................ 179
Appliances .......................................................... 182
Electronic Products ............................................ 183
Optical Media ..................................................... 184
Wire & Cable ....................................................... 186
Electronic Components/Other Applications .......... 187
Resins ................................................................. 190
Medical & Consumer .......................................... 192
Medical .............................................................. 194
Recreational Products ....................................... 196
Other Uses ........................................................ 197
Resins ................................................................. 198
Construction ....................................................... 200
Glazing & Skylights ............................................ 202
Pipe & Fittings .................................................... 203
Lighting & Other Uses ........................................ 204
Resins ................................................................. 205
Industrial ........................................................... 207
Applications ....................................................... 207
Resins ................................................................. 209
Other Markets .................................................... 211
Packaging ........................................................... 212
Other Transportation Equipment ....................... 213
Furniture & Fixtures .......................................... 214
All Other ............................................................ 215
Resins ................................................................. 216

INDUSTRY STRUCTURE
General ............................................................... 218
Industry Composition .......................................... 219
Market Share ....................................................... 221
Mergers & Acquisitions ....................................... 225
Marketing Strategies ........................................... 228
Channels of Distribution ..................................... 229
Research & Development .................................... 230
Competitive Strategies ........................................ 231
Cooperative Agreements ..................................... 233

COMPANY PROFILES
Arkema SA .......................................................... 237
Asahi Kasei ........................................................ 240
Ascend Performance Materials ......................... 242
BASF SE ........................................................... 243
Bayer AG ............................................................ 247
Celanese Corporation ......................................... 249
Chevron Phillips Chemical ................................. 255
Daikin Industries ............................................... 257
DuPont (EI) de Nemours ...................................... 259

(continued on following page)
Table of Contents

(continued from previous page)

4 Nylon Demand in Motor Vehicle Markets...59
5 Nylon Demand in Electrical & Electronics Markets...............61
6 Nylon Demand in Medical & Consumer Markets...............63
7 Nylon Capacity, 2014..........................68
8 Acrylonitrile-Butadiene-Styrene
   Supply & Demand.................................71
9 Acrylonitrile-Butadiene-Styrene
   Demand by Market...............................72
Cht Acrylonitrile-Butadiene-Styrene
   Demand by Market, 2014........................73
10 ABS Demand in Electrical & Electronic Markets.............75
11 ABS Demand in Motor Vehicle Markets........77
12 ABS Demand in Construction Markets........78
13 ABS Demand in Medical & Consumer Markets........80
14 Acrylonitrile-Butadiene-Styrene
   Capacity, 2014.................................84
15 Polycarbonate Supply & Demand..................86
16 Polycarbonate Demand by Market........87
Cht Polycarbonate Demand by Market, 2014....88
17 Polycarbonate Demand in
   Electrical & Electronics Markets.............90
18 Polycarbonate Demand in
   Medical & Consumer Markets........92
19 Polycarbonate Demand in
   Motor Vehicle Markets................94
20 Polycarbonate Demand in
   Construction Markets................96
21 Polycarbonate Capacity, 2014.................99
22 Thermoplastic Polyester
   Demand by Resin..............................101
23 Polybutylene Terephthalate
   Capacity, 2014.................................103
24 Thermoplastic Polyester
   Demand by Market............................107
Cht Thermoplastic Polyester Demand by Market, 2014........108
25 Thermoplastic Polyester Demand
   in Motor Vehicle Markets................110
26 Thermoplastic Polyester Demand in
   Electrical & Electronics Markets........111
27 Thermoplastic Polyester Demand in
   Medical & Consumer Markets...........112
28 Polycarbonate Supply & Demand...............114
29 Polycarbonate Demand by Market........115
Cht Polycarbonate Demand by Market, 2014.....116
30 Polycarbonate Capacity, 2014.............120
31 Fluoropolymer Supply & Demand...............122
32 Fluoropolymer Demand by Market........130
Cht Fluoropolymer Demand by Market, 2014....131
33 Polycarbonate Oxide Demand................140
34 Polycarbonate Oxide Demand by Market......141
Cht Polycarbonate Oxide Demand by Market, 2014....142
35 Sulfone Polymer Demand..................146
36 Sulfone Polymer Demand by Market..........147
37 Polyphenylene Sulfide Demand...............152
38 Polyphenylene Sulfide
   Demand by Market.............................153
39 Polyphenylene Sulfide Capacity, 2014........157
40 Polymides Demand............................159
41 Polymides Demand by Market................160
42 Other Engineering Plastics
   Demand by Type...............................163

MARKETS
1 Engineering Plastics Demand by Market...168
   Cht Engineering Plastics Demand
   by Market, 2014..............................169
2 Motor Vehicle Market for Engineering
   Plastics by Application..................171
   Cht Motor Vehicle Market for Engineering
   Plastics by Application, 2014............172
3 Motor Vehicle Market for Engineering
   Plastics by Resin............................179
4 Electrical & Electronics Market for
   Engineering Plastics by Application......181
   Cht Electrical & Electronics Market
   for Engineering Plastics by Application
   for Engineering Plastics by Application
   by Application, 2014.......................182
5 Electrical & Electronics Market for
   Engineering Plastics by Resin.............192
6 Medical & Consumer Market for
   Engineering Plastics by Application........193
   Cht Medical & Consumer Market for Engineering
   Plastics by Application, 2014............194
7 Medical & Consumer Market for
   Engineering Plastics by Resin.............200
8 Construction Market for Engineering
   Plastics by Application..................201
   Cht Construction Market for Engineering
   Plastics by Application, 2014............202
9 Construction Market for Engineering
   Plastics by Resin............................206
10 Industrial Market for Engineering Plastics...208
11 Industrial Market for Engineering
   Plastics by Resin.........................210
12 Other Markets for Engineering
   Plastics by Application....................211
13 Other Markets for Engineering
   Plastics by Resin.........................217

INDUSTRY STRUCTURE
1 US Engineering Plastics Sales by Company, 2014............220
   Cht Engineering Plastics Market Share, 2014...221
2 Selected Acquisitions & Divestitures...............227
3 Selected Cooperative Agreements..............235
Replacement of metal parts with engineering plastics will continue to drive growth, as will new technological advancements that allow engineering plastics to penetrate new applications.

US demand to rise 2.6% annually through 2019

Demand for engineering plastics in the US is expected to rise 2.6 percent per year to 5.1 billion pounds in 2019. Replacement of metal parts with engineering plastics will continue to drive growth, as will new technological advancements that allow engineering plastics to penetrate new applications. However, increased demand for engineering plastics will be tempered by weak growth in mature markets as well as increasing competition from lower cost commodity resins.

Construction, medical markets to grow fastest

The largest markets for engineering plastics will continue to be the motor vehicle and electrical and electronic markets. The motor vehicle market will increasingly rely on engineering plastics to reduce vehicle weight in order to improve fuel efficiency. However, the construction and the medical and consumer markets will provide the fastest growth. A significant rebound in construction activity is projected going forward and will provide opportunities for engineering plastics, especially in applications such as lighting, window glazing, and skylights for nonresidential buildings. Medical applications will continue to drive growth going forward because of engineering plastic resins’ mechanical strength, ability to withstand sterilizing processes, and compatibility with the human body.

Nylon to lead gains among largest volume resins

Nylon, acrylonitrile-butadiene-styrene (ABS), and polycarbonate will continue to be the three largest engineering plastics by volume, accounting for three-quarters of total demand in 2019. Nylon will post the most rapid increases of the three and will remain the largest engineering plastic. This growth will be driven mainly by nylon supplanting metals in underhood motor vehicle applications. Gains for ABS will be the slowest of all engineering plastics, restrained by competition from lower-cost resins and maturity in major applications. Polycarbonate will benefit from strong growth in the construction and the medical and consumer markets, but overall will track the industry average due to the continued decline in CD and DVD sales.

Smaller-volume engineering plastics such as polyphenylene sulfide, sulfone polymers, fluoropolymers, and polyketones will exhibit the fastest growth. Specialized use in mature markets, as well as utilization in new products such as advanced batteries, photovoltaic modules, and medical implants, will drive overall demand. These resins will see greater use in electrical and electronic and motor vehicle markets, where they are typically used to fill specific high-temperature needs and their greater cost can be economically justified.

Copyright 2015 The Freedonia Group, Inc.
RESINS

Nylon

Demand for nylon is expected to increase 3.0 percent per annum from 2009 through 2019 to a level of 1.4 billion pounds. Continued replacement of metal parts in motor vehicles and industrial products with nylon, which provides high strength, rigidity, and abrasion resistance, will fuel demand growth and absorb any excess capacity. Nylon demand grew at a brisk annual rate of 9.1 percent from 2004 to 2009. Continued replacement of metal parts in automotive applications such as air-intake manifolds, valve covers, and fan shrouds. Threats to additional growth include competition from specialty polypropylene grades and other engineering resins, although high-heat specialty nylons such as polyphthalamide will take share from other high-value engineering plastics in more demanding applications.

Nylons, also known as polyamides, are among the oldest engineering plastics. Nylons exhibit high strength and stiffness, good chemical and abrasion resistance, a low coefficient of friction, and fair electrical properties. In addition, nylons have a high softening point and are often durable at low temperatures. Nylons exhibit considerable variation in flexibility and stiffness and can be tailored to meet performance requirements for a variety of uses.

The two dominant grades of nylon are nylon 6 and nylon 6/6, which account for the bulk of demand because they provide premium stiffness, strength, and heat resistance. Nylon 6 has a lower melting point than nylon 6/6 and is more moisture absorbent. Other nylon types include nylon 6/10, 6/12, 6/6/6, 6/6/11, and 12, which are specialty products that demand higher prices. High-temperature nylons include polyphenylene oxide and polyphenylene sulfide. The capacity to absorb moisture gives nylons dimensional stability, although the specialty nylon types have lower moisture absorption.

Nylons are among the oldest engineering plastics.

TABLE III-1

ENGINEERING PLASTICS DEMAND BY RESIN
(million pounds)

<table>
<thead>
<tr>
<th>Item</th>
<th>2004</th>
<th>2009</th>
<th>2014</th>
<th>2019</th>
<th>2024</th>
</tr>
</thead>
<tbody>
<tr>
<td>Durable Goods Shipments (bil 2009$)</td>
<td>2433</td>
<td>1955</td>
<td>2540</td>
<td>2775</td>
<td>2970</td>
</tr>
<tr>
<td>lb resin/000$ durables</td>
<td>1.80</td>
<td>1.74</td>
<td>1.77</td>
<td>1.84</td>
<td>1.91</td>
</tr>
<tr>
<td>Engineering Plastics Demand</td>
<td>4376</td>
<td>3406</td>
<td>4500</td>
<td>5110</td>
<td>5660</td>
</tr>
<tr>
<td>Nylon</td>
<td>1018</td>
<td>780</td>
<td>1205</td>
<td>1400</td>
<td>1580</td>
</tr>
<tr>
<td>Acrylonitrile-Butadiene-Styrene</td>
<td>1324</td>
<td>979</td>
<td>1196</td>
<td>1310</td>
<td>1410</td>
</tr>
<tr>
<td>Polycarbonate</td>
<td>1033</td>
<td>864</td>
<td>983</td>
<td>1110</td>
<td>1220</td>
</tr>
<tr>
<td>Thermoplastic Polyesters</td>
<td>432</td>
<td>318</td>
<td>471</td>
<td>533</td>
<td>593</td>
</tr>
<tr>
<td>Polyacetal</td>
<td>253</td>
<td>183</td>
<td>240</td>
<td>276</td>
<td>303</td>
</tr>
<tr>
<td>Fluoropolymers</td>
<td>120</td>
<td>117</td>
<td>152</td>
<td>184</td>
<td>216</td>
</tr>
<tr>
<td>Polyphenylene Oxide</td>
<td>126</td>
<td>96</td>
<td>144</td>
<td>160</td>
<td>175</td>
</tr>
<tr>
<td>Sulfone Polymers</td>
<td>29</td>
<td>31</td>
<td>45</td>
<td>57</td>
<td>67</td>
</tr>
<tr>
<td>Polyphenylene Sulfide</td>
<td>20</td>
<td>16</td>
<td>28</td>
<td>36</td>
<td>42</td>
</tr>
<tr>
<td>Polyimides</td>
<td>15</td>
<td>14</td>
<td>23</td>
<td>27</td>
<td>34</td>
</tr>
<tr>
<td>Other Engineering Plastics</td>
<td>6</td>
<td>8</td>
<td>13</td>
<td>17</td>
<td>20</td>
</tr>
<tr>
<td>$/lb</td>
<td>1.54</td>
<td>1.86</td>
<td>2.20</td>
<td>2.40</td>
<td>2.63</td>
</tr>
<tr>
<td>Engineering Plastics Demand (mil $)</td>
<td>6742</td>
<td>6329</td>
<td>9898</td>
<td>12275</td>
<td>14860</td>
</tr>
</tbody>
</table>

Source: The Freedonia Group, Inc.
Polymeric Resources Corporation
55 Haul Road
Wayne, NJ 07470
973-694-4141
http://www.customresins.com

Annual Sales: $150 million (estimated)
Employment: 450 (estimated)

Key Products: nylon, polyphenylene ether, polybutylene terephthalate, polyethylene terephthalate, and polycarbonate and polycarbonate alloys

Polymeric Resources, through its subsidiaries, is a privately held compounder specializing in engineering thermoplastics. The Company is also back integrated in the production of nylon polymers.

The Company is active in the US engineering plastics industry through the production of such products as NYLENE nylon, NORPEX polyphenylene ether (PPE), VEXEL polybutylene terephthalate (PBT) and polyethylene terephthalate (PET), and NAXEL polycarbonate and polycarbonate alloys. Available in standard and specialty grades, the resins are suitable for injection and blow molding, extrusion, film extrusion, and rotational molding applications mainly in the automotive, consumer goods, process manufacturing and home appliance industries.

NYLENE nylon resins include nylon 6, nylon 6/6, nylon 6/9, and nylon 6/12 formulations. For example, the company makes NYLENE nylon 6 resins in standard grades, as well as mineral-filled, glass-filled, nucleated, impact-modified, and other varieties. Among other performance properties, NYLENE products feature enhanced dimensional stability, optimal flow characteristics, and high abrasion resistance.

TABLE IV-3
MOTOR VEHICLE MARKET FOR ENGINEERING PLASTICS BY RESIN (million pounds)

<table>
<thead>
<tr>
<th>Item</th>
<th>2004</th>
<th>2009</th>
<th>2014</th>
<th>2019</th>
<th>2024</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering Plastics in Motor Vehicles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nylon</td>
<td>427</td>
<td>242</td>
<td>552</td>
<td>649</td>
<td>724</td>
</tr>
<tr>
<td>ABS</td>
<td>343</td>
<td>170</td>
<td>355</td>
<td>378</td>
<td>399</td>
</tr>
<tr>
<td>Thermoplastic Polyesters</td>
<td>183</td>
<td>96</td>
<td>210</td>
<td>231</td>
<td>252</td>
</tr>
<tr>
<td>Polycarbonate</td>
<td>169</td>
<td>85</td>
<td>188</td>
<td>204</td>
<td>218</td>
</tr>
<tr>
<td>Polyacetal</td>
<td>83</td>
<td>41</td>
<td>69</td>
<td>82</td>
<td>86</td>
</tr>
<tr>
<td>Polyphenylene Oxide</td>
<td>50</td>
<td>28</td>
<td>65</td>
<td>71</td>
<td>77</td>
</tr>
<tr>
<td>Other Resins</td>
<td>27</td>
<td>19</td>
<td>36</td>
<td>45</td>
<td>54</td>
</tr>
<tr>
<td>$/lb Eng Plastics in Motor Vehicles (mil $)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Source: The Freedonia Group, Inc.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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.

Credit Card Orders
For convenience, Freedonia accepts American Express, MasterCard or Visa. Credit card purchases must include account number, expiration date and authorized signature.

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).

Corporate Use License
Now every decision maker in your organization can act on the key intelligence found in all Freedonia studies. For an additional $2600, companies receive unlimited use of an electronic version (PDF) of the study. Place it on your intranet, email it to coworkers around the world, or print it as many times as you like.

Order Form

Engineering Plastics................................................. $5300

☐ Corporate Use License (add to study price) *
☐ Additional Print Copies @ $600 each *
☐ Enclosed is my check (5% discount) drawn on a US bank and payable to The Freedonia Group, Inc., in US funds (Ohio residents add 8% sales tax)
☐ Bill my company ☐ American Express ☐ MasterCard ☐ Visa

Name__________________________________________
Title__________________________________________
Company_______________________________________
Division________________________________________
Street__________________________________________
(No PO Box please)
City/State/Zip_________________________________
Country________________________________________

Credit Card # ________________________________
Expires mm/yy _____________________________

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 $2600; one additional user, add $600; two additional users, add $1200; three additional users, add $1800.

☐ 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______________________________________

The Freedonia Group, Inc. • 767 Beta Drive • Cleveland, OH • 44143-2326 • USA • Website: www.freedoniagroup.com
Tel US: 800.927.5900 or +1 440.684.9600 • Fax: +1 440.646.0484 • Email: info@freedoniagroup.com
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 and other world markets. Industries analyzed by Freedonia include:

- Automotive & Transport
- Chemicals
- Construction & Building Products
- Consumer Goods
- Energy & Petroleum
- Industrial Components
- Healthcare & Life Sciences
- Machinery & Equipment
- Metals, Minerals & Glass
- Packaging
- Plastics & Other Polymers
- Security
- Services
- Textiles & Nonwovens
- Water Treatment

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.

Click here to learn more about Freedonia

Click here to learn more about Custom Research

Click here for complete title list

Click to visit freedoniagroup.com