



# **Nanocomposites, Nanoparticles, Nanoclays and Nanotubes:** *Global Markets to 2022*

June 2018

*Andrew McWilliams*

Report Code: NAN021H

# Table of Contents

<b>Chapter 1: Introduction</b> .....	<b>1</b>
Study Goals and Objectives .....	1
Reasons for Doing This Study .....	1
Scope of Report .....	1
Information Sources .....	2
Methodology .....	2
Geographic Breakdown .....	2
Analyst's Credentials .....	5
Related BCC Research Reports .....	5
<b>Chapter 2: Summary and Highlights</b> .....	<b>7</b>
<b>Chapter 3: Market and Technology Background</b> .....	<b>10</b>
General Description .....	10
Definitions .....	10
Brief History of Nanocomposites .....	10
General Properties of Nanocomposites vs. Conventional Composites .....	11
Increased Tensile Strength, Modulus, and Heat Distortion Temperature .....	11
Color/Transparency .....	11
Conductivity .....	12
Flame Retardancy .....	12
Barrier Properties .....	12
Anticorrosive Properties .....	12
Types of Nanocomposites, Their Properties and Applications .....	13
Clay Nanocomposites .....	13
Ceramic Nanocomposites .....	31
Carbon Nanotube Composites .....	41
Metal-Containing Nanocomposites .....	50
Metal Oxide-Containing Nanocomposites .....	51
Nanobiocomposites .....	52
Other Types of Nanocomposites .....	56
<b>Chapter 4: Global Market for Nanocomposites</b> .....	<b>64</b>
Summary .....	64
Nanocomposite Consumption by Country/Region .....	64
Nanocomposite Consumption by Type of Material .....	67
Nanocomposite Consumption by Type of Application .....	69
<b>Chapter 5: U.S. Market for Nanocomposites</b> .....	<b>73</b>
Summary .....	73
Nanocomposite Consumption by Type of Material .....	74
Nanocomposite Consumption by Type of Application .....	76
Detailed Market Projections .....	79
Clay Nanocomposites .....	79
Ceramic Nanocomposites .....	85
Carbon Nanotube Composites .....	90
Metal/Metal Oxide Containing Nanocomposites .....	98

Nanobiocomposites .....	99
Other Types of Nanocomposites .....	103
<b>Chapter 6: European Markets for Nanocomposites .....</b>	<b>110</b>
Summary.....	110
Nanocomposite Consumption by Type of Material .....	111
Nanocomposite Consumption by Type of Application .....	113
Detailed Market Projections .....	115
Clay Nanocomposites .....	115
Ceramic Nanocomposites.....	120
Carbon Nanotube Composites .....	126
Metal/Metal Oxide Containing Nanocomposites .....	133
Other Types of Nanocomposites .....	136
<b>Chapter 7: Asia-Pacific Market for Nanocomposites .....</b>	<b>143</b>
Summary.....	143
Nanocomposite Consumption by Type of Material .....	143
Nanocomposite Consumption by Type of Application .....	146
Detailed Market Projections .....	149
Clay Nanocomposites .....	149
Ceramic Nanocomposites.....	154
Carbon Nanotube Composites .....	159
Metal/Metal Oxide Containing Nanocomposites .....	169
Nanobiocomposites .....	169
Other Types of Nanocomposites .....	172
<b>Chapter 8: Rest of World Markets for Nanocomposites and Industry Structure .</b>	<b>179</b>
Summary.....	179
Nanocomposite Consumption by Type of Material .....	179
Nanocomposite Consumption by Type of Application .....	182
Suppliers .....	184
Market Shares .....	184
<b>Chapter 9: Patent Review/New Developments .....</b>	<b>187</b>
Patents by Type of Nanocomposite .....	187
Patent Holders .....	188
Individual Entities .....	188
Commercial vs. Other Types of Assignees.....	190
<b>Chapter 10: Company Profiles.....</b>	<b>194</b>
<b>About BCC Research .....</b>	<b>207</b>
About BCC Research .....	208
BCC Membership.....	208
BCC Custom Research.....	208

# List of Tables

Summary Table Global Nanocomposite Market, by Type, Through 2022 (MT/\$ Millions).....	7
Table 1 Properties and Main Applications of Principal Types of Commercial Clay Nanocomposites .....	22
Table 2 Other Clay Nanocomposites .....	26
Table 3 Principal Applications of Clay Containing Composites .....	27
Table 4 Clay Nanocomposite Suppliers .....	29
Table 5 Properties and Main Applications of Principal Types of Ceramic-containing Nanocomposites ....	36
Table 6 Principal Applications of Ceramic-containing Composites .....	38
Table 7 Ceramic Nanocomposite Suppliers .....	41
Table 8 Properties of Carbon Nanotube Composites .....	44
Table 9 Principal Applications of Nanotube Composites.....	46
Table 10 Carbon Nanotube Composite Suppliers .....	50
Table 11 Global Market for Nanocomposites, by Region, Through 2022 (\$ Millions) .....	64
Table 12 Global Market Share for Nanocomposites, by Region, 2016 vs. 2022 (%) .....	65
Table 13 Global Market for Nanocomposites, by Type, Through 2022 (MT/\$ Millions).....	67
Table 14 Global Market Share for Nanocomposites, by Region, 2016 vs. 2022 (%) .....	68
Table 15 Global Market for Nanocomposites, by Application, 2016 vs. 2022 (\$ Millions/%) .....	70
Table 16 U.S. Market for Nanocomposites, by Type, Through 2022 (MT/\$ Millions).....	73
Table 17 U.S. Market Share for Nanocomposites, by Type, 2016 vs. 2022 (%) .....	75
Table 18 U.S. Market for Nanocomposites, by Application, 2016 vs. 2022 (\$ Millions/%) .....	77
Table 19 U.S. Market for Clay Nanocomposites, by Type, Through 2022 (MT/\$ Millions) .....	79
Table 20 U.S. Market for Clay-Based Nanocomposites, by End Use, 2016 vs. 2022 (\$ Millions/%) .....	80
Table 21 U.S. Market for Nylon/Montmorillonite Nanocomposites, by Segment, 2016 (MT/%).....	81
Table 22 U.S. Market for Nylon/Montmorillonite Nanocomposites, by Segment, Through 2022 (MT/\$ Millions) .....	83
Table 23 U.S. Market for EVA/Montmorillonite Nanocomposites, Through 2022 (MT/\$ Millions) .....	84
Table 24 U.S. Market for Other Clay Nanocomposites, Through 2022 (MT/\$ Millions) .....	84
Table 25 U.S. Market for Ceramic Nanocomposites, by Type, Through 2022 (MT/\$ Millions) .....	85
Table 26 U.S. Market Share for Ceramic Nanocomposites, by End Use, 2016 vs. 2022 (%).....	86
Table 27 U.S. Market for Polyurethane/Alumina Nanocomposites, Through 2022 (MT/\$ Millions) .....	88
Table 28 U.S. Market for Alumina/Titania Nanocomposites, Through 2022 (MT/\$ Millions).....	89
Table 29 U.S. Market for Calcium Phosphate/Silica Nanocomposite Bone Substitutes, Through 2022 (MT/\$ Millions).....	89
Table 30 U.S. Market for Tungsten Carbide Nanocomposites, Through 2022 (MT/\$ Millions) .....	90
Table 31 U.S. Market for Carbon Nanotube Composites, by Type, Through 2022 (MT/\$ Millions) .....	91
Table 32 U.S. Market Share for Carbon Nanotube-Based Composites, by Segment, 2016 vs. 2022 (%)...	92
Table 33 U.S. Automotive Market for Nylon/Nanotube Composites, by Segment, 2016 (\$ Millions/%) ..	93
Table 34 U.S. Automotive Market for Nylon/Nanotube Composites, by Segment, Through 2022 (MT/\$ Millions) .....	94
Table 35 U.S. Market for Polycarbonate/Nanotube Composites, Through 2022 (MT/\$ Millions) .....	95
Table 36 U.S. Market for Polybutylene Terephthalate/Nanotube Composites, Through 2022 (MT/\$ Millions) .....	96
Table 37 U.S. Market for Polyphenylene/Nanotube Composites, Through 2022 (MT/\$ Millions).....	96
Table 38 U.S. Market for Epoxy/Carbon Nanotube Composites, Through 2022 (MT/\$ Millions) .....	97
Table 39 U.S. Market for PVOH/SWNT Composite Fiber, Through 2022 (MT/\$ Millions) .....	98
Table 40 U.S. Market for Graphene/Polymer Composites, Through 2022 (MT/\$ Millions).....	98
Table 41 U.S. Market for Magnetic Nanocomposites, Through 2022 (MT/\$ Millions) .....	99
Table 42 U.S. Market for Nanobiocomposites, by Type, Through 2022 (MT/\$ Millions).....	100

Table 43 U.S. Market for Nanobiocomposites, by Application, 2022 (\$ Millions, %)	100
Table 44 U.S. Market for PVOH/Cellulose Nanocomposites, Through 2022 (MT/\$ Millions)	101
Table 45 U.S. Market for Cotton/Clay Nanocomposite Fabrics, Through 2022 (MT/\$ Millions)	102
Table 46 U.S. Market for Other Nanocomposites, by Type, Through 2022 (MT/\$ Millions)	103
Table 47 U.S. Market for Other Nanocomposites, by Segment, 2016 vs. 2022 (\$ Millions/%)	104
Table 48 U.S. Market for POSS-containing Nanocomposites, Through 2022 (MT/\$ Millions)	106
Table 49 U.S. Market for Nanocomposite Fuel-Cell Membrane, Through 2022 (MT/\$ Millions)	107
Table 50 U.S. Market for Photonic Band Gap Nanocomposites, Through 2022 (MT/\$ Millions)	108
Table 51 European Market for Nanocomposites, by Type, Through 2022 (MT/\$ Millions)	110
Table 52 European Market Share for Nanocomposites, by Type, 2016 vs. 2022 (%)	111
Table 53 European Market for Nanocomposites, by Application, 2016 vs. 2022 (\$ Millions/%)	113
Table 54 European Market for Clay Nanocomposites, by Type, Through 2022 (MT/\$ Millions)	115
Table 55 European Market for Clay-Based Nanocomposites, by End Use, 2016 vs. 2022 (\$ Millions/%)	116
Table 56 European Market for Nylon/Montmorillonite Nanocomposite, by Segment 2016 (MT/%)	117
Table 57 European Market for Nylon/Montmorillonite Nanocomposites, by Segment, Through 2022 (MT/\$ Millions)	119
Table 58 European Market for EVA/Montmorillonite Nanocomposites, Through 2022 (MT/\$ Millions)	119
Table 59 European Market for Other Clay Nanocomposites, Through 2022 (MT/\$ Millions)	120
Table 60 European Market for Ceramic Nanocomposites, by Type, Through 2022 (MT/\$ Millions)	121
Table 61 European Market for Ceramic Nanocomposites, by End Use, 2016 vs. 2022 (\$ Millions/%)	122
Table 62 European Market for Polyurethane/Alumina Nanocomposites, Through 2022 (MT/\$ Millions)	124
Table 63 European Market for Alumina/Titania Nanocomposites, Through 2022 (MT/\$ Millions)	125
Table 64 European Market for Calcium Phosphate/Silica Nanocomposite Bone Substitutes, Through 2022 (MT/\$ Millions)	125
Table 65 European Market for Tungsten Carbide Nanocomposites, Through 2022 (MT/\$ Millions)	126
Table 66 European Market for Carbon Nanotube Composites, by Type, Through 2022 (MT/\$ Millions)	127
Table 67 European Market for Carbon Nanotube-Based Composites, by Segment, 2016 vs. 2022 (\$ Millions/%)	128
Table 68 European Automotive Market for Nylon/Nanotube Composites, by Segment 2016 (\$ Millions/%)	129
Table 69 European Automotive Market for Nylon/Nanotube Composites, by Segment Through 2022 (MT/\$ Millions)	130
Table 70 European Market for Polycarbonate/Nanotube Composites, Through 2022 (MT/\$ Millions)	131
Table 71 European Market for Polybutylene Terephthalate/Nanotube Composites, Through 2022 (MT/\$ Millions)	132
Table 72 European Market for Polyphenylene/Nanotube Composites, Through 2022 (MT/\$ Millions)	132
Table 73 European Market for PVOH/SWNT Composite Fibers, Through 2022 (MT/\$ Millions)	133
Table 74 European Market for Graphene/Polymer Composites, Through 2022 (MT/\$ Millions)	133
Table 75 European Market for Magnetic Nanocomposites, Through 2022 (MT/\$ Millions)	134
Table 76 European Market for Nanobiocomposites, by Type, Through 2022 (MT/\$ Millions)	134
Table 77 European Market for Nanobiocomposites, by Application, 2022 (\$ Millions/%)	135
Table 78 European Market for PVOH/Cellulose Nanocomposites, Through 2022 (MT/\$ Millions)	136
Table 79 European Market for Cotton/Clay Nanocomposite Fabrics, Through 2022 (MT/\$ Millions)	136
Table 80 European Market for Other Nanocomposites, by Type, Through 2022 (MT/\$ Millions)	137
Table 81 European Market for Other Composites, by Segment, 2016 vs. 2022 (\$ Millions/%)	137
Table 82 European Market for POSS-containing Nanocomposites, Through 2022 (MT/\$ Millions)	139
Table 83 European Market for Nanocomposite Fuel-Cell Membranes, Through 2022 (MT/\$ Millions)	140
Table 84 European Market for Photonic Band Gap Nanocomposites, Through 2022 (MT/\$ Millions)	140
Table 85 European Market for Hydrophobic/Oleophobic Nanocomposites, Through 2022 (MT/\$ Millions)	141

Table 86 Asia-Pacific Market for Nanocomposites, by Type, Through 2022 (MT/\$ Millions) .....	143
Table 87 Asia-Pacific Market Share for Nanocomposites, by Type, 2016 vs. 2022 (%).....	144
Table 88 Asia-Pacific Market for Nanocomposites, by Application, 2016 vs. 2022 (\$ Millions/%) .....	147
Table 89 Asia-Pacific Market for Clay Nanocomposites, by Type, Through 2022 (MT/\$ Millions) .....	149
Table 90 Asia-Pacific Market for Clay-Based Nanocomposites, by End Use, 2016 vs. 2022 (\$ Millions/%) .....	150
Table 91 Asia-Pacific Market for Nylon/Montmorillonite Nanocomposite, by Segment, 2016 (MT/%)..	151
Table 92 Asia-Pacific Market for Nylon/Montmorillonite Nanocomposites, by Segment, Through 2022 (MT/\$ Millions).....	153
Table 93 Asia-Pacific Market for EVA/Montmorillonite Nanocomposites, Through 2022 (MT/\$ Millions) .....	153
Table 94 Asia-Pacific Market for Other Clay Nanocomposites, Through 2022 (MT/\$ Millions) .....	154
Table 95 Asia-Pacific Market for Ceramic Nanocomposites, by Type, Through 2022 (MT/\$ Millions)....	155
Table 96 Asia-Pacific Market for Ceramic Nanocomposites, by End Use, 2016 vs. 2022 (\$ Millions/%) .	156
Table 97 Asia-Pacific Market for Polyurethane/Alumina Nanocomposites, Through 2022 (MT/\$ Millions) .....	158
Table 98 Asia-Pacific Market for Alumina/Titania Nanocomposites, Through 2022 (MT/\$ Millions) .....	158
Table 99 Asia-Pacific Market for Calcium Phosphate/Silica Nanocomposite Bone Substitutes, Through 2022 (MT/\$ Millions) .....	159
Table 100 Asia-Pacific Market for Tungsten Carbide Nanocomposites, Through 2022 (MT/\$ Millions) .	159
Table 101 Asia-Pacific Market for Carbon Nanotube Composites, by Type, Through 2022 (MT/\$ Millions) .....	160
Table 102 Asia-Pacific Market for Carbon Nanotube-Based Composites, by End Use, 2016 vs. 2022 (\$ Millions/%) .....	161
Table 103 Asia-Pacific Automotive Market for Nylon/Nanotube Composites, by Segment, 2016 (\$ Millions/%) .....	163
Table 104 Asia-Pacific Automotive Market for Nylon/Nanotube Composites, by Segment Through 2022 (MT/\$ Millions).....	165
Table 105 Asia-Pacific Market for Polycarbonate/Nanotube Composites, Through 2022 (MT/\$ Millions) .....	165
Table 106 Asia-Pacific Market for Polybutylene Terephthalate/Nanotube Composites, Through 2022 (MT/\$ Millions).....	166
Table 107 Asia-Pacific Market for Polyphenylene/Nanotube Composites, Through 2022 (MT/\$ Millions) .....	167
Table 108 Asia-Pacific Market for Epoxy/Carbon Nanotube Composites, Through 2022 (MT/\$ Millions) .....	167
Table 109 Asia-Pacific Market for Polyurethane/Fullerene Nanocomposites, Through 2022 (MT/\$ Millions) .....	168
Table 110 Asia-Pacific Market for PVOH/SWNT Composite Fibers, Through 2022 (MT/\$ Millions) .....	168
Table 111 Asia-Pacific Market for Graphene/Polymer Composites, Through 2022 (MT/\$ Millions) .....	169
Table 112 Asia-Pacific Market for Magnetic Nanocomposites, Through 2022 (MT/\$ Millions).....	169
Table 113 Asia-Pacific Market for Nanobiocomposites, by Type, Through 2022 (MT/\$ Millions) .....	170
Table 114 Asia-Pacific Market for Nanobiocomposites, by Application, 2022 (\$ Millions/%).....	170
Table 115 Asia-Pacific Market for PVOH/Cellulose Nanocomposites, Through 2022 (MT/\$ Millions)....	172
Table 116 Asia-Pacific Market for Cotton/Clay Nanocomposite Fabrics, Through 2022 (MT/\$ Millions)	172
Table 117 Asia-Pacific Market for Other Nanocomposites, by Type, Through 2022 (MT/\$ Millions) .....	173
Table 118 Asia-Pacific Market for Other Composites, by Segment, 2016 vs. 2022 (\$ Millions/%) .....	174
Table 119 Asia-Pacific Market for POSS-containing Nanocomposites, Through 2022 (MT/\$ Millions) ...	175
Table 120 Asia-Pacific Market for Nanocomposite Fuel Cell Membranes, Through 2022 (MT/\$ Millions) .....	176

Table 121 Asia-Pacific Market for Photonic Band Gap Nanocomposites, Through 2022 (MT/\$ Millions)	177
Table 122 RoW Market for Nanocomposites, by Type, Through 2022 (MT/\$ Millions)	180
Table 123 RoW Market Share for Nanocomposites, by Type, 2016 vs. 2022 (%)	181
Table 124 RoW Market for Nanocomposites, by Application, 2016 vs. 2022 (\$ Millions/%)	183
Table 125 U.S. Nanocomposite Patents, by Class, 1976-November 2017 (Number/%)	187
Table 126 Major Nanocomposite Patent Holders, by Assignee, 1976-November 2017 (Number/%)	189
Table 127 U.S. Nanocomposite Patents Issued, by Assignee Type, 1976-November 2017 (Number/%)	190
Table 128 Nanocomposite Patents Issued, by Assignee Country, 1976-November 2017 (Number/%)	191

# List of Figures

Summary Figure Global Nanocomposite Market, 2016-2022 (MT/\$ Millions) .....	7
Figure 1 Global Market for Nanocomposites, by Region, 2016-2022 (\$ Millions) .....	65
Figure 2 Global Market Share for Nanocomposites, by Region, 2016 vs. 2022 (%) .....	66
Figure 3 Global Market Share for Nanocomposites, by Type, 2016 vs. 2022 (%) .....	68
Figure 4 Global Market Share for Nanocomposites, by Application, 2016 vs. 2022 (%) .....	70
Figure 5 Trends in the U.S. Nanocomposite Market, 2016-2022 (\$ Millions) .....	74
Figure 6 U.S. Market Share for Nanocomposites, by Type, 2016 vs. 2022 (%) .....	75
Figure 7 U.S. Market Share for Nanocomposites, by Application, 2016 vs. 2022 (%) .....	78
Figure 8 U.S. Market Share for Clay-Based Nanocomposites, by End Use, 2016 vs. 2022 (%) .....	80
Figure 9 U.S. Market Share for Nylon/Montmorillonite Nanocomposites, 2016 (%) .....	82
Figure 10 U.S. Market Share for Ceramic Nanocomposites, by End Use, 2016 vs. 2022 (%) .....	86
Figure 11 U.S. Market Share for Carbon Nanotube-Based Composites, 2016 vs. 2022 (%) .....	92
Figure 12 U.S. Automotive Market Share for Nylon/Nanotube Composites, 2016 (%) .....	94
Figure 13 U.S. Market Share for Nanobiocomposites, by Application, 2022 (%) .....	101
Figure 14 U.S. Market Share for Other Nanocomposites, 2016 vs. 2022 (%) .....	105
Figure 15 Trends in European Nanocomposite Market, 2016-2022 (\$ Millions) .....	111
Figure 16 European Market Share for Nanocomposites, by Type, 2016 vs. 2022 (%) .....	112
Figure 17 European Market Share for Nanocomposites, by Application, 2016 vs. 2022 (%) .....	114
Figure 18 European Market Share for Clay-Based Nanocomposites, by End Use, 2016 vs. 2022 (%) .....	116
Figure 19 European Market Share for Nylon/Montmorillonite Nanocomposite, 2016 (%) .....	118
Figure 20 European Market Share for Ceramic Nanocomposites, by End Use, 2016 vs. 2022 (%) .....	123
Figure 21 European Market Share for Carbon Nanotube-Based Composites, 2016 vs. 2022 (%) .....	128
Figure 22 European Automotive Market Share for Nylon/Nanotube Composites, 2016 (%) .....	130
Figure 23 European Market Share for Nanobiocomposites, by Application, 2022 (%) .....	135
Figure 24 European Market Share for Other Composites, 2016 vs. 2022 (%) .....	138
Figure 25 Trends in Asia-Pacific Nanocomposite Market, 2016-2022 (\$ Millions) .....	144
Figure 26 Asia-Pacific Market Share for Nanocomposites, by Type, 2016 vs. 2022 (%) .....	145
Figure 27 Asia-Pacific Market Share for Nanocomposites, by Application, 2016 vs. 2022 (%) .....	148
Figure 28 Asia-Pacific Market Share for Clay-Based Nanocomposites, by End Use, 2016 vs. 2022 (%) .....	150
Figure 29 Asia-Pacific Market for Nylon/Montmorillonite Nanocomposite, 2016 (MT/%) .....	152
Figure 30 Asia-Pacific Market Share for Ceramic Nanocomposites, by End Use, 2016 vs. 2022 (%) .....	157
Figure 31 Asia-Pacific Market Share for Carbon Nanotube-Based Composites, by End Use, 2016 vs. 2022 (%) .....	162
Figure 32 Asia-Pacific Automotive Market Share for Nylon/Nanotube Composites, 2016 (%) .....	164
Figure 33 Asia-Pacific Market Share for Nanobiocomposites, by Application, 2022 (%) .....	171
Figure 34 Asia-Pacific Market Share for Other Composites, 2016 vs. 2022 (%) .....	174
Figure 35 Trends in ROW Nanocomposite Markets, 2016-2022 (\$ Millions) .....	181
Figure 36 ROW Market Share for Nanocomposites, by Type, 2016 vs. 2022 (%) .....	182
Figure 37 ROW Market Share for Nanocomposites, by Application, 2016 vs. 2022 (%) .....	183
Figure 38 Nanocomposite Suppliers' Market Share, 2016 (%) .....	185
Figure 39 U.S. Nanocomposite Patents Share, by Type, 1976-November 2017 (%) .....	188
Figure 40 Major Nanocomposite Patent Holders Share, by Assignee, 1976-November 2017 (%) .....	189
Figure 41 U.S. Nanocomposite Patents Issued Share, by Assignee Type, 1976-November 2017 (%) .....	190
Figure 42 Nanocomposite Patents Issued Share, by Assignee Country, 1976–November 2017 (%) .....	192





*About BCC Research*

## *About BCC Research*

With our unparalleled 45-year history, BCC Research provides comprehensive analysis of global market sizing, forecasting and industry intelligence, covering markets where advances in science and technology are improving the quality, standard and sustainability of businesses, economies and lives.

## *BCC Membership*

From market sizing and forecasts, to opportunity assessments and competitive analyses, our ever-expanding library gives you the data, insights and intelligence required to ensure your project is a success. Members benefit from ongoing, unlimited access to the category or collections of their choice, and most membership packages pay for themselves within two to three reports being accessed.

Did you buy this report? You may qualify to apply your purchase price towards a full membership. Call 866-285-7215 or email [info@bccresearch.com](mailto:info@bccresearch.com) to request a demo.

## *BCC Custom Research*

Our experts provide custom research projects to those working to identify new markets, introduce new products, validate existing market share, analyze competition and assess the potential for products to impact existing markets. With impressive academic credentials and broad and deep knowledge of global industrial markets, our independent analysts and consultants develop the facts, figures, analysis and assessments to inform the decisions that will move your company ahead. Confidential inquiries to: [custom@bccresearch.com](mailto:custom@bccresearch.com) or 781-205-2429.

## DISCLAIMER

The information developed in this report is intended to be as reliable as possible at the time of publication and is of a professional nature. This information does not constitute managerial, legal or accounting advice, nor should it be considered as a corporate policy guide, laboratory manual or an endorsement of any product, as much of the information is speculative in nature. BCC Research and the author assume no responsibility for any loss or damage that might result from reliance on the reported information or from its use.

ISBN: 978-1-62296-728-5  
June 2018