

| | |
|--|----|
| CHAPTER ONE: INTRODUCTION..... | 1 |
| STUDY GOALS AND OBJECTIVES..... | 1 |
| REASONS FOR DOING THE STUDY | 2 |
| SCOPE OF REPORT | 2 |
| INTENDED AUDIENCE..... | 3 |
| INFORMATION SOURCES..... | 3 |
| BCC ONLINE SERVICES..... | 4 |
| DISCLAIMER | 4 |
| CHAPTER TWO: SUMMARY..... | 5 |
| SUMMARY..... | 5 |
| <i>SUMMARY TABLE GLOBAL MARKET FOR MICROSPHERES, BY</i> <i>INDUSTRY, THROUGH 2015 (\$ MILLIONS)</i> | 6 |
| <i>SUMMARY FIGURE GLOBAL MARKET FOR MICROSPHERES, BY</i> <i>INDUSTRY, 2009-2015 (\$ MILLIONS)</i> | 6 |
| CHAPTER THREE: OVERVIEW | 7 |
| DEFINITION OF MICROSPHERES..... | 7 |
| INDUSTRY OVERVIEW | 7 |
| <i>TABLE 1 MICROSPHERE MARKETS AND APPLICATIONS</i> | 8 |
| <i>TABLE 1 (CONTINUED)</i> | 9 |
| <i>TABLE 1 (CONTINUED)</i> | 10 |
| <i>TABLE 1 (CONTINUED)</i> | 11 |
| HISTORY OF THE INDUSTRY..... | 11 |
| ADVANTAGES OF MICROSPHERES | 12 |
| BALL BEARING EFFECT | 12 |
| HIGHER FILLER LOADING | 12 |
| SURFACE QUALITY..... | 13 |
| WEIGHT REDUCTION | 13 |
| <i>TABLE 2 TYPICAL BENEFITS OF MICROSPHERES</i> | 13 |
| PRICING STRUCTURE | 14 |
| CHAPTER FOUR: MARKET ANALYSIS BY INDUSTRY | 15 |
| COMPOSITES INDUSTRY..... | 15 |
| SYNTACTIC FOAMS..... | 16 |
| CONSTRUCTION MATERIALS | 17 |
| Thermosets..... | 17 |
| Panel Systems..... | 18 |
| Cement Additives | 18 |
| Flooring, Grouts and Caulk | 18 |
| OIL AND GAS EXPLORATION..... | 18 |
| Oil and Gas Exploration (Continued) | 19 |
| TRENDS IN THE INDUSTRY | 20 |
| INDUSTRY FORECAST..... | 21 |
| North America and Europe/Africa/Middle East..... | 21 |

| | |
|--|----|
| Asia–Pacific..... | 21 |
| GLOBAL MICROSHERE MARKET FOR COMPOSITES BY REGION, MATERIALS AND APPLICATIONS..... | 22 |
| Global Composite Market by Geographic Region..... | 22 |
| <i>TABLE 3 2010 GLOBAL MARKET FOR MICROSPHERES IN COMPOSITES, BY GEOGRAPHIC REGION (\$ MILLIONS, % MARKET SHARES)</i> | 22 |
| <i>FIGURE 1 2010 GLOBAL MARKET FOR MICROSPHERES IN COMPOSITES, BY GEOGRAPHIC REGION (% MARKET SHARES)</i> | 22 |
| <i>TABLE 4 2015 GLOBAL MARKET FORECAST FOR MICROSPHERES IN COMPOSITES, BY GEOGRAPHIC REGION (\$ MILLIONS, % MARKET SHARES)</i> | 23 |
| <i>TABLE 5 GLOBAL MARKET FORECAST FOR MICROSPHERES IN COMPOSITES, BY GEOGRAPHIC REGION, THROUGH 2015 (\$ MILLIONS)</i> | 23 |
| <i>FIGURE 2 GLOBAL MARKET FORECAST FOR MICROSPHERES IN COMPOSITES, BY GEOGRAPHIC REGION, 2009-2015 (\$ MILLIONS)</i> | 24 |
| Global Composite Market by Raw Material..... | 24 |
| <i>TABLE 6 2010 GLOBAL MARKET FOR MICROSPHERES IN COMPOSITES, BY RAW MATERIAL (\$ MILLIONS, % MARKET SHARES)</i> | 24 |
| <i>FIGURE 3 2010 GLOBAL MARKET FOR MICROSPHERES IN COMPOSITES, BY RAW MATERIAL (\$ MILLIONS)</i> | 25 |
| <i>TABLE 7 GLOBAL MARKET FORECAST FOR MICROSPHERES IN COMPOSITES, BY RAW MATERIAL, THROUGH 2015 (\$ MILLIONS)</i> | 25 |
| <i>FIGURE 4 GLOBAL MARKET FORECAST FOR MICROSPHERES IN COMPOSITES, BY RAW MATERIAL, 2009-2015 (\$ MILLIONS)</i> | 26 |
| Global Composite Market by End–Use Application..... | 26 |
| <i>TABLE 8 2010 GLOBAL MARKET FOR MICROSPHERES IN COMPOSITES, BY END–USE APPLICATION (\$ MILLIONS, % MARKET SHARES)</i> | 26 |
| <i>FIGURE 5 2010 GLOBAL MARKET FOR MICROSPHERES IN COMPOSITES, BY END–USE APPLICATION (\$ MILLIONS)</i> | 27 |
| <i>TABLE 9 GLOBAL MARKET FORECAST FOR MICROSPHERES IN COMPOSITES, BY END–USE APPLICATION, THROUGH 2015 (\$ MILLIONS)</i> | 27 |
| <i>FIGURE 6 GLOBAL MARKET FORECAST FOR MICROSPHERES IN COMPOSITES, BY END–USE APPLICATION, 2009-2015 (\$ MILLIONS)</i> | 28 |
| MEDICAL TECHNOLOGY INDUSTRY: TREATMENTS, DEVICES, DIAGNOSTICS..... | 28 |
| FILLERS FOR SOFT AND HARD TISSUE (COSMETIC AND RECONSTRUCTIVE SURGERY, UROLOGY)..... | 29 |

| | |
|---|----|
| EMBOLIZATION THERAPIES | 30 |
| DRUG DELIVERY VEHICLES (CANCER TREATMENTS)..... | 31 |
| Drug Delivery Vehicles...(Continued) | 32 |
| MEDICAL DEVICES | 33 |
| TRENDS IN THE INDUSTRY | 34 |
| INDUSTRY FORECAST..... | 35 |
| GLOBAL MICROSPHERE MARKET FOR MEDICAL TECHNOLOGY BY REGION, MATERIALS AND APPLICATIONS | 36 |
| Global Medical Technology Market by Geographic Region | 36 |
| <i>TABLE 10 2010 GLOBAL MARKET FOR MICROSPHERES IN MEDICINE, BY GEOGRAPHIC REGION (\$ MILLIONS, % MARKET SHARES)</i> | 36 |
| <i>FIGURE 7 2010 GLOBAL MARKET FOR MICROSPHERES IN MEDICINE, BY GEOGRAPHIC REGION (% MARKET SHARES)</i> | 37 |
| <i>TABLE 11 2015 GLOBAL MARKET FOR MICROSPHERES IN MEDICINE, BY GEOGRAPHIC REGION (\$ MILLIONS, % MARKET SHARES)</i> | 37 |
| <i>TABLE 12 GLOBAL MARKET FORECAST FOR MICROSPHERES IN MEDICINE, BY GEOGRAPHIC REGION, 2009-2015 (\$ MILLIONS)</i> | 38 |
| <i>FIGURE 8 GLOBAL MARKET FORECAST FOR MICROSPHERES IN MEDICINE, BY GEOGRAPHIC REGION, 2009-2015 (\$ MILLIONS)</i> | 38 |
| Global Medical Technology Market by Raw Material..... | 39 |
| <i>TABLE 13 2010 GLOBAL MARKET FOR MICROSPHERES IN MEDICINE, BY RAW MATERIAL (\$ MILLIONS, % MARKET SHARES)</i> | 39 |
| <i>FIGURE 9 2010 GLOBAL MARKET FOR MICROSPHERES IN MEDICINE, BY RAW MATERIAL (% MARKET SHARES)</i> | 39 |
| <i>TABLE 14 GLOBAL MARKET FORECAST FOR MICROSPHERES IN MEDICINE, BY RAW MATERIAL, THROUGH 2015 (\$ MILLIONS)</i> | 40 |
| <i>FIGURE 10 GLOBAL MARKET FORECAST FOR MICROSPHERES IN MEDICINE, BY RAW MATERIAL, 2009-2015 (\$ MILLIONS)</i> | 40 |
| Global Medical Technology Market by End-Use Application..... | 41 |
| <i>TABLE 15 2010 GLOBAL MARKET FOR MICROSPHERES IN MEDICINE, BY END-USE APPLICATION (\$ MILLIONS, % MARKET SHARES)</i> | 41 |
| <i>FIGURE 11 2010 GLOBAL MARKET FOR MICROSPHERES IN MEDICINE, BY END-USE APPLICATION (% MARKET SHARES)</i> | 41 |
| <i>TABLE 16 GLOBAL MARKET FORECAST FOR MICROSPHERES IN MEDICINE, BY END-USE APPLICATION, THROUGH 2015 (\$ MILLIONS)</i> | 42 |
| <i>FIGURE 12 GLOBAL MARKET FORECAST FOR MICROSPHERES IN MEDICINE, BY END-USE APPLICATION, 2009-2015 (\$ MILLIONS)</i> | 42 |

| | |
|--|----|
| LIFE SCIENCES INDUSTRY..... | 42 |
| LIFE SCIENCES INDUSTRY (CONTINUED)..... | 43 |
| LIFE SCIENCES INDUSTRY (CONTINUED)..... | 44 |
| COATINGS IN LIFE SCIENCES..... | 45 |
| TRENDS IN THE INDUSTRY | 46 |
| INDUSTRY FORECAST:..... | 46 |
| GLOBAL MICROSPHERE MARKET FOR LIFE SCIENCES BY REGION, MATERIALS AND APPLICATIONS..... | 47 |
| Global Life Sciences Market by Geographic Region | 47 |
| <i>TABLE 17 2010 GLOBAL MARKET FOR MICROSPHERES IN LIFE SCIENCES, BY GEOGRAPHIC REGION (\$ MILLIONS, % MARKET SHARE)</i> | 47 |
| <i>FIGURE 13 2010 GLOBAL MARKET FOR MICROSPHERES IN LIFE SCIENCES, BY GEOGRAPHIC REGION (% MARKET SHARE)</i> | 48 |
| <i>TABLE 18 2015 GLOBAL MARKET FOR MICROSPHERES IN LIFE SCIENCES, BY GEOGRAPHIC REGION (\$ MILLIONS, % MARKET SHARE)</i> | 48 |
| <i>TABLE 19 GLOBAL MARKET FORECAST FOR MICROSPHERES IN LIFE SCIENCES, BY GEOGRAPHIC REGION, THROUGH 2015 (\$ MILLIONS)</i> | 49 |
| <i>FIGURE 14 GLOBAL MARKET FORECAST FOR MICROSPHERES IN LIFE SCIENCES, BY GEOGRAPHIC REGION, 2009-2015 (\$ MILLIONS)</i> | 49 |
| Global Life Sciences Market by Raw Material | 50 |
| <i>TABLE 20 2010 GLOBAL MARKET FOR MICROSPHERES IN LIFE SCIENCES, BY RAW MATERIAL (\$ MILLIONS, % MARKET SHARE)</i> | 50 |
| <i>FIGURE 15 2010 GLOBAL MARKET FOR MICROSPHERES IN LIFE SCIENCES, BY RAW MATERIAL (% MARKET SHARE)</i> | 50 |
| <i>TABLE 21 GLOBAL MARKET FORECAST FOR MICROSPHERES IN LIFE SCIENCES, BY RAW MATERIAL, THROUGH 2015 (\$ MILLIONS)</i> | 51 |
| <i>FIGURE 16 GLOBAL MARKET FORECAST FOR MICROSPHERES IN LIFE SCIENCES, BY RAW MATERIAL, 2009-2015 (\$ MILLIONS)</i> | 51 |
| PERSONAL CARE INDUSTRY | 51 |
| PERSONAL CARE INDUSTRY (CONTINUED) | 52 |
| PERSONAL CARE INDUSTRY (CONTINUED) | 53 |
| TRENDS IN THE INDUSTRY | 54 |
| Trends in the Industry (Continued)..... | 55 |
| INDUSTRY FORECAST..... | 56 |
| GLOBAL MICROSPHERE MARKET FOR PERSONAL CARE BY REGION, MATERIALS AND APPLICATIONS..... | 57 |
| Global Personal Care Market by Geographic Region | 57 |

| | |
|---|----|
| <i>TABLE 22 2010 GLOBAL MARKET FOR MICROSPHERES IN PERSONAL CARE, BY GEOGRAPHIC REGION (\$ MILLIONS, % MARKET SHARE)</i> | 57 |
| <i>FIGURE 17 2010 GLOBAL MARKET FOR MICROSPHERES IN PERSONAL CARE, BY GEOGRAPHIC REGION (% MARKET SHARE)</i> | 57 |
| <i>TABLE 23 2015 GLOBAL MARKET FORECAST FOR MICROSPHERES IN PERSONAL CARE, BY GEOGRAPHIC REGION (\$ MILLIONS, % MARKET SHARE)</i> | 58 |
| <i>TABLE 24 GLOBAL MARKET FORECAST FOR MICROSPHERES IN PERSONAL CARE, BY GEOGRAPHIC REGION, THROUGH 2015 (\$ MILLIONS)</i> | 58 |
| <i>FIGURE 18 GLOBAL MARKET FORECAST FOR MICROSPHERES IN PERSONAL CARE, BY GEOGRAPHIC REGION, 2009-2015 (\$ MILLIONS)</i> | 59 |
| Global Personal Care Market by Raw Material..... | 59 |
| <i>TABLE 25 2010 GLOBAL MARKET FOR MICROSPHERES IN PERSONAL CARE, BY RAW MATERIAL (\$ MILLIONS, % MARKET SHARE)</i> | 59 |
| <i>FIGURE 19 2010 GLOBAL MARKET FOR MICROSPHERES IN PERSONAL CARE, BY RAW MATERIAL (% MARKET SHARE)</i> | 60 |
| SOURCE: BCC RESEARCH..... | 60 |
| <i>TABLE 26 GLOBAL MARKET FORECAST FOR MICROSPHERES IN PERSONAL CARE, BY RAW MATERIAL, THROUGH 2015 (\$ MILLIONS)</i> | 60 |
| <i>FIGURE 20 GLOBAL MARKET FORECAST FOR MICROSPHERES IN PERSONAL CARE, BY RAW MATERIAL, 2009-2015 (\$ MILLIONS)</i> | 61 |
| Global Personal Care Market by End-Use Application..... | 61 |
| <i>TABLE 27 2010 GLOBAL MARKET FOR MICROSPHERES IN PERSONAL CARE, BY END-USE APPLICATION (\$ MILLIONS, % MARKET SHARE)</i> | 61 |
| <i>FIGURE 21 2010 GLOBAL MARKET FOR MICROSPHERES IN PERSONAL CARE, BY END-USE APPLICATION (% MARKET SHARE)</i> | 62 |
| <i>TABLE 28 GLOBAL MARKET FORECAST FOR MICROSPHERES IN PERSONAL CARE, BY END-USE APPLICATION, THROUGH 2015 (\$ MILLIONS)</i> | 62 |
| <i>FIGURE 22 GLOBAL MARKET FORECAST FOR MICROSPHERES IN PERSONAL CARE, BY END-USE APPLICATION, 2009-2015 (\$ MILLIONS)</i> | 63 |
| SPECIALTY MICROSPHERES..... | 63 |
| OTHER INDUSTRIES..... | 63 |
| ADDITIVES/SPECIALTY CHEMICALS/MATERIALS..... | 64 |
| PAINTS..... | 64 |

| | |
|---|-----------|
| Paints ...(CONTINUED)..... | 65 |
| COATINGS..... | 66 |
| <i>TABLE 29 BENEFITS OF MICROSPHERES IN PAINTS AND</i> | |
| <i>COATINGS.....</i> | <i>67</i> |
| EMI SHIELDING..... | 68 |
| TECHNICAL TEXTILES AND NONWOVEN..... | 69 |
| LEATHER..... | 69 |
| PRINTING INKS | 69 |
| REFRACTORY | 69 |
| AEROSPACE..... | 69 |
| SPACERS | 70 |
| RETROREFLECTIVE/HIGHWAY SAFETY | 70 |
| CONSUMER PRODUCTS | 71 |
| EXPLOSIVES..... | 71 |
| GRINDING AND DISPERSION MEDIA..... | 71 |
| Paint and Coatings Industry..... | 72 |
| Ceramic Industry..... | 72 |
| Pest Control | 72 |
| Cosmetics and Pharmaceuticals | 72 |
| BLASTING APPLICATIONS | 72 |
| Blasting Applications (Continued)..... | 73 |
| CHAPTER FIVE: MARKET ANALYSIS BY TYPE OF MICROSPHERES | 74 |
| OVERVIEW OF MICROSPHERES | 74 |
| SOLID GLASS MICROSPHERES | 74 |
| PRIMARY APPLICATIONS AND BENEFITS..... | 74 |
| Fillers for Plastics..... | 74 |
| Retroreflective Media | 75 |
| Blasting and Grinding Media..... | 76 |
| Medicine and Life Sciences | 76 |
| MANUFACTURING PROCESSES | 76 |
| HOLLOW GLASS MICROSPHERES | 77 |
| PRIMARY APPLICATIONS AND BENEFITS..... | 77 |
| Lightweight Filler..... | 77 |
| Lightweight Filler (Continued) | 78 |
| MANUFACTURING PROCESS | 79 |
| SOLID POLYMER MICROSPHERES | 80 |
| APPLICATIONS AND BENEFITS | 80 |
| Polyethylene Microspheres | 80 |
| Eco-friendly Manufacturing | 80 |
| Safety of Polyethylene in Cosmetics | 80 |
| PMMA Microspheres | 81 |
| Polystyrene Microspheres | 81 |
| Polyamide (Nylon) Microspheres | 82 |
| Acetal Microspheres | 82 |

| | |
|--|-----|
| Polytetrafluoroethylene/Teflon (PTFE) Microspheres | 82 |
| Polypropylene Microspheres | 83 |
| Biodegradable Microspheres | 83 |
| Fluorescent Microspheres | 84 |
| Opaque Microspheres | 85 |
| Colored Microspheres | 85 |
| MANUFACTURING PROCESSES | 86 |
| Emulsion Polymerization | 86 |
| Spray Drying Process | 87 |
| Prilling/Melt Spraying..... | 88 |
| HOLLOW POLYMER MICROSPHERES..... | 89 |
| PRIMARY APPLICATIONS AND BENEFITS..... | 89 |
| Primary Applications and Benefits (CONTINUED) | 90 |
| MANUFACTURING PROCESS | 91 |
| HOLLOW CERAMIC MICROSPHERES..... | 91 |
| PRIMARY APPLICATIONS AND BENEFITS..... | 91 |
| Lightweight Filler..... | 92 |
| Low Density | 92 |
| High Melting Point | 92 |
| Low Thermal Conductivity..... | 93 |
| Low Oil Absorption | 93 |
| Inertness..... | 93 |
| Hardness | 93 |
| Electrical Properties | 93 |
| Good Packing Factor | 94 |
| Typical Applications | 94 |
| Typical Applications (Continued)..... | 95 |
| MANUFACTURING PROCESS | 96 |
| SOLID CERAMIC MICROSPHERES..... | 97 |
| PRIMARY APPLICATIONS AND BENEFITS..... | 97 |
| Silica Microspheres..... | 97 |
| Zirconium Oxide Microspheres | 98 |
| Aluminum Oxide Microspheres | 98 |
| MANUFACTURING PROCESSES | 99 |
| METAL, METAL-COATED MICROSPHERES..... | 99 |
| METAL | 99 |
| METAL COATED MICROSPHERES | 100 |
| MANUFACTURING PROCESSES | 101 |
| MAGNETIC MICROSPHERES | 101 |
| PARAMAGNETIC MICROSPHERES | 102 |
| PARAMAGNETIC MICROSPHERES (CONTINUED) | 103 |
| MANUFACTURING PROCESSES | 104 |
| Mechanical Attrition | 104 |
| Nozzle Reactor Systems | 104 |

| | |
|---|------------|
| SPECIALTY COATINGS FOR MICROSPHERES | 105 |
| SURFACE TREATMENT | 105 |
| IRON OXIDE COATING | 105 |
| TITANIA COATING | 106 |
| FLOW VISUALIZATION COATING | 106 |
| GLOBAL MARKET FORECAST BY TYPE OF MICROSPHERES | 106 |
| CERAMIC MICROSPHERES..... | 106 |
| <i>TABLE 30 2010 GLOBAL MARKET FOR CERAMIC MICROSPHERES</i> | |
| <i>(\$ MILLIONS, % MARKET SHARES)</i> | <i>107</i> |
| <i>FIGURE 23 2010 GLOBAL MARKET FOR CERAMIC MICROSPHERES</i> | |
| <i>(% MARKET SHARES)</i> | <i>107</i> |
| PARAMAGNETIC MICROSPHERES | 107 |
| <i>TABLE 31 GLOBAL MARKET FORECAST FOR CERAMIC</i> | |
| <i>MICROSPHERES, THROUGH 2015 (\$ MILLIONS).....</i> | <i>108</i> |
| <i>FIGURE 24 GLOBAL MARKET FORECAST FOR CERAMIC</i> | |
| <i>MICROSPHERES, 2009-2015 (\$ MILLIONS).....</i> | <i>108</i> |
| GLASS MICROSPHERES | 109 |
| <i>TABLE 32 2010 GLOBAL MARKET FOR GLASS MICROSPHERES (\$</i> | |
| <i>MILLIONS, % MARKET SHARES).....</i> | <i>109</i> |
| <i>FIGURE 25 2010 GLOBAL MARKET FOR GLASS MICROSPHERES (%</i> | |
| <i>MARKET SHARES).....</i> | <i>110</i> |
| <i>TABLE 33 GLOBAL MARKET FORECAST FOR GLASS</i> | |
| <i>MICROSPHERES, THROUGH 2015 (\$ MILLIONS).....</i> | <i>110</i> |
| <i>FIGURE 26 GLOBAL MARKET FORECAST FOR GLASS</i> | |
| <i>MICROSPHERES, 2009-2015 (\$ MILLIONS).....</i> | <i>111</i> |
| POLYMER MICROSPHERES..... | 111 |
| <i>TABLE 34 2010 GLOBAL MARKET FOR POLYMER MICROSPHERES</i> | |
| <i>(\$ MILLIONS, % MARKET SHARES)</i> | <i>112</i> |
| <i>FIGURE 27 2010 GLOBAL MARKET FOR POLYMER MICROSPHERES</i> | |
| <i>(% MARKET SHARES)</i> | <i>113</i> |
| <i>TABLE 35 GLOBAL MARKET FORECAST FOR POLYMER</i> | |
| <i>MICROSPHERES, THROUGH 2015 (\$ MILLIONS).....</i> | <i>113</i> |
| <i>FIGURE 28 GLOBAL MARKET FORECAST FOR POLYMER</i> | |
| <i>MICROSPHERES, 2009-2015 (\$ MILLIONS).....</i> | <i>114</i> |
| SPECIALTY MICROSPHERES | 114 |
| <i>TABLE 36 2010 GLOBAL MARKET FOR SPECIALTY MICROSPHERES</i> | |
| <i>(\$ MILLIONS, % MARKET SHARES)</i> | <i>115</i> |
| <i>FIGURE 29 2010 GLOBAL MARKET FOR SPECIALTY</i> | |
| <i>MICROSPHERES (% MARKET SHARES).....</i> | <i>115</i> |
| <i>TABLE 37 GLOBAL MARKET FORECAST FOR SPECIALTY</i> | |
| <i>MICROSPHERES, THROUGH 2015 (\$ MILLIONS).....</i> | <i>116</i> |
| <i>FIGURE 30 GLOBAL MARKET FORECAST FOR SPECIALTY</i> | |
| <i>MICROSPHERES, 2009-2015 (\$ MILLIONS).....</i> | <i>116</i> |

| | |
|---|-----|
| CHAPTER SIX: GLOBAL MARKET ANALYSIS BY GEOGRAPHIC REGION..... | 117 |
| NORTH AMERICAN MARKET..... | 117 |
| <i>TABLE 38 2010 MARKET FOR MICROSPHERES BY INDUSTRY IN NORTH AMERICA (\$ MILLIONS, % MARKET SHARES)</i> | 118 |
| <i>FIGURE 31 2010 MARKET FOR MICROSPHERES BY INDUSTRY IN NORTH AMERICA (% MARKET SHARES)</i> | 119 |
| <i>TABLE 39 2015 MARKET FOR MICROSPHERES BY INDUSTRY IN NORTH AMERICA (\$ MILLIONS, % MARKET SHARES)</i> | 119 |
| <i>FIGURE 32 2015 MARKET FOR MICROSPHERES BY INDUSTRY IN NORTH AMERICA (% MARKET SHARES)</i> | 120 |
| <i>TABLE 40 MARKET FORECAST FOR MICROSPHERES BY INDUSTRY, IN NORTH AMERICA THROUGH 2015 (\$ MILLIONS)</i> | 120 |
| <i>FIGURE 33 MARKET FORECAST FOR MICROSPHERES BY INDUSTRY, IN NORTH AMERICA, 2009-2015 (\$ MILLIONS)</i> | 121 |
| EUROPE, AFRICA AND MIDDLE EAST MARKET..... | 121 |
| <i>TABLE 41 2010 MARKET FOR MICROSPHERES BY INDUSTRY IN EUROPE, AFRICA AND MIDDLE EAST (\$ MILLIONS, % MARKET SHARES)</i> | 122 |
| <i>FIGURE 34 2010 MARKET FOR MICROSPHERES BY INDUSTRY IN EUROPE, AFRICA AND MIDDLE EAST (% MARKET SHARES)</i> | 123 |
| <i>TABLE 42 2015 MARKET FOR MICROSPHERES BY INDUSTRY IN EUROPE, AFRICA AND MIDDLE EAST (\$ MILLIONS, % MARKET SHARES)</i> | 123 |
| <i>FIGURE 35 2015 MARKET FOR MICROSPHERES BY INDUSTRY IN EUROPE, AFRICA AND MIDDLE EAST (% MARKET SHARES)</i> | 124 |
| <i>TABLE 43 MARKET FORECAST FOR MICROSPHERES BY INDUSTRY, IN EUROPE, AFRICA AND MIDDLE EAST, THROUGH 2015 (\$ MILLIONS)</i> | 124 |
| <i>FIGURE 36 MARKET FORECAST FOR MICROSPHERES BY INDUSTRY, IN EUROPE, AFRICA AND MIDDLE EAST, 2009-2015 (\$ MILLIONS)</i> | 125 |
| ASIA-PACIFIC REGION MARKET..... | 125 |
| <i>TABLE 44 2010 MARKET FOR MICROSPHERES BY INDUSTRY IN ASIA-PACIFIC REGION (\$ MILLIONS, % MARKET SHARES)</i> | 126 |
| <i>FIGURE 37 2010 MARKET FOR MICROSPHERES BY INDUSTRY IN ASIA-PACIFIC REGION (% MARKET SHARES)</i> | 127 |
| <i>TABLE 45 2015 MARKET FOR MICROSPHERES BY INDUSTRY IN ASIA-PACIFIC REGION (\$ MILLIONS, % MARKET SHARES)</i> | 127 |
| <i>FIGURE 38 2015 MARKET FOR MICROSPHERES BY INDUSTRY IN ASIA-PACIFIC REGION (% MARKET SHARES)</i> | 128 |
| <i>TABLE 46 MARKET FORECAST FOR MICROSPHERES BY INDUSTRY, IN ASIA-PACIFIC REGION, THROUGH 2015 (\$ MILLIONS)</i> | 128 |

| | |
|--|-----|
| <i>FIGURE 39 MARKET FORECAST FOR MICROSPHERES BY INDUSTRY, IN ASIA-PACIFIC REGION, 2009-2015 (\$ MILLIONS)</i> | 129 |
| <i>THE REST OF THE WORLD MARKET</i> | 129 |
| <i>TABLE 47 2010 MARKET FOR MICROSPHERES BY INDUSTRY IN THE REST OF THE WORLD (\$ MILLIONS, % MARKET SHARES)</i> | 130 |
| <i>FIGURE 40 2010 MARKET FOR MICROSPHERES BY INDUSTRY IN THE REST OF THE WORLD (% MARKET SHARES)</i> | 130 |
| <i>TABLE 48 2015 MARKET FOR MICROSPHERES BY INDUSTRY IN THE REST OF THE WORLD (\$ MILLIONS, % MARKET SHARES)</i> | 131 |
| <i>FIGURE 41 2015 MARKET FOR MICROSPHERES BY INDUSTRY IN THE REST OF THE WORLD (% MARKET SHARES)</i> | 131 |
| <i>TABLE 49 MARKET FORECAST FOR MICROSPHERES BY INDUSTRY, IN THE REST OF THE WORLD, THROUGH 2015 (\$ MILLIONS)</i> | 132 |
| <i>FIGURE 42 MARKET FORECAST FOR MICROSPHERES BY INDUSTRY, IN THE REST OF THE WORLD, 2009-2015 (\$ MILLIONS)</i> | 132 |
| <i>GLOBAL MARKET BY REGION SUMMARY</i> | 133 |
| <i>TABLE 50 2010 GLOBAL MARKET FOR MICROSPHERES, BY GEOGRAPHIC REGION (\$ MILLIONS, % MARKET SHARES)</i> | 134 |
| <i>FIGURE 43 2010 GLOBAL MARKET FOR MICROSPHERES, BY GEOGRAPHIC REGION (% MARKET SHARES)</i> | 134 |
| <i>TABLE 51 2015 GLOBAL MARKET FOR MICROSPHERES, BY GEOGRAPHIC REGION (\$ MILLIONS, % MARKET SHARES)</i> | 135 |
| <i>FIGURE 44 2015 GLOBAL MARKET FOR MICROSPHERES, BY GEOGRAPHIC REGION (% MARKET SHARES)</i> | 135 |
| <i>TABLE 52 GLOBAL MARKET FORECAST FOR MICROSPHERES, BY GEOGRAPHIC REGION, THROUGH 2015 (\$ MILLIONS)</i> | 136 |
| <i>FIGURE 45 GLOBAL MARKET FORECAST FOR MICROSPHERES, BY GEOGRAPHIC REGION, 2009-2015 (\$ MILLIONS)</i> | 136 |
| <i>GLOBAL MARKET BY INDUSTRY SUMMARY</i> | 136 |
| <i>TABLE 53 2010 GLOBAL MARKET FOR MICROSPHERES, BY INDUSTRY (\$ MILLIONS, % MARKET SHARES)</i> | 137 |
| <i>FIGURE 46 2010 GLOBAL MARKET FOR MICROSPHERES, BY INDUSTRY (% MARKET SHARES)</i> | 138 |
| <i>TABLE 54 2015 GLOBAL MARKET FOR MICROSPHERES, BY INDUSTRY (\$ MILLIONS, % MARKET SHARES)</i> | 138 |
| <i>FIGURE 47 2015 GLOBAL MARKET FOR MICROSPHERES, BY INDUSTRY (% MARKET SHARES)</i> | 139 |
| <i>TABLE 55 GLOBAL MARKET FOR MICROSPHERES, BY INDUSTRY, THROUGH 2015 (\$ MILLIONS)</i> | 139 |
| <i>FIGURE 48 GLOBAL MARKET FOR MICROSPHERES, BY INDUSTRY, 2009-2015 (\$ MILLIONS)</i> | 140 |

| | |
|--|-----|
| CHAPTER SEVEN: SELECTION OF MICROSPHERES: CRITICAL PARAMETERS..... | 141 |
| COMPOSITION | 141 |
| SPECIFIC GRAVITY..... | 141 |
| CRUSH STRENGTH | 142 |
| WALL THICKNESS | 142 |
| PARTICLE SIZE AND PARTICLE SIZE DISTRIBUTION | 143 |
| ELECTROSTATIC CHARGE..... | 143 |
| OPTICAL CHARACTERISTICS | 144 |
| COLOR | 145 |
| OPERATING TEMPERATURE | 145 |
| COST LIMITATIONS:..... | 145 |
| SPECIAL PROPERTIES | 146 |
| COMPETING PRODUCTS..... | 146 |
| MICROSPHERES VS. TRADITIONAL FILLERS | 146 |
| MICROSPHERES VS. TRADITIONAL PIGMENTS | 146 |
| SAFETY AND ENVIRONMENTAL CONSIDERATIONS: | 147 |
| LIMITATIONS | 147 |
| CHAPTER EIGHT: COMPANY PROFILES AND PRODUCTS OVERVIEW | 148 |
| 3M CORPORATION | 148 |
| ASIA PACIFIC MICROSPHERES (APM) | 149 |
| AVEKA MANUFACTURING INC. | 150 |
| BANGS LABORATORIES, INC..... | 150 |
| BAYER MATERIAL SCIENCE LLC | 151 |
| BIOSPHERE MEDICAL, INC..... | 152 |
| COSPHERIC LLC..... | 152 |
| ECO OIL ARGENTINA | 153 |
| EMD CHEMICALS (ASSOCIATE OF MERCK KGAA) | 153 |
| EXPANCEL (AKZONOBEL) | 154 |
| INDUCHEM AG | 155 |
| KOBO PRODUCTS..... | 155 |
| LIFE TECHNOLOGIES | 156 |
| LUMINEX CORPORATION | 157 |
| MERCK KGAA..... | 158 |
| MOMENTIVE PERFORMANCE MATERIALS..... | 159 |
| MO–SCI CORPORATION | 160 |
| PHOSPHOREX | 161 |
| PIOMA CHEMICALS | 162 |
| POLYSCIENCES INC. | 162 |
| PORAVER | 163 |
| POTTERS INDUSTRIES | 164 |
| <i>TABLE 56 POTTERS INDUSTRIES MARKETS AND PRODUCTS</i> | 165 |
| SIGMUND LINDNER GMBH..... | 166 |
| SPHEROTECH | 166 |

| | |
|--|-----|
| SUNJIN CHEMICAL | 167 |
| TAGRA BIOTECHNOLOGIES | 168 |
| TRELLEBORG OFFSHORE BOSTON, INC. | 168 |
| TRELLEBORG OFFSHORE BOSTON, INC. (CONTINUED) | 169 |
| CHAPTER NINE: ADVANCES IN TECHNOLOGY | 170 |
| PROCESS FOR PREPARATION OF SWELLABLE AND DEFORMABLE MICROSPHERES | 170 |
| MICROSPHERES AS THICKENING AGENTS FOR ORGANIC PEROXIDES | 170 |
| INJECTABLE HYDROGEL MICROSPHERES FROM AQUEOUS TWO-PHASE SYSTEM | 171 |
| MAGNETIC POLYMER MICROBEADS AND METHOD FOR PREPARING THE SAME | 171 |
| SELF-ENCODING SENSOR WITH MICROSPHERES | 172 |
| USE OF ADSORBENT CARBON MICROSPHERES FOR THE TREATMENT OF IRRITABLE BOWEL SYNDROME | 172 |
| POLYMERIC MICROSPHERES AS DEGRADABLE FLUID LOSS ADDITIVES IN OILFIELD APPLICATIONS..... | 172 |
| PAVEMENT MARKING, REFLECTIVE ELEMENTS, AND METHODS OF MAKING MICROSPHERES..... | 173 |
| SOLAR SENSOR HAVING MICROSPHERES ON THE INSIDE FACE OF THE PROTECTIVE CAP | 173 |
| MAGNETIC MICROSPHERES FOR USE IN FLUORESCENCE- BASED APPLICATIONS | 173 |
| SOLID PERFUMED PREPARATION IN THE FORM OF MICROBEADS AND THE USE THEREOF | 174 |
| PROLONGED RELEASE BIODEGRADABLE MICROSPHERES AND METHOD FOR PREPARING SAME | 174 |
| POLYVINYL ALCOHOL MICROSPHERES, INJECTABLE SOLUTIONS AND THERAPEUTIC USES OF THE SAME | 175 |
| SYNTHETIC MICROSPHERES COMPRISING ALUMINOSILICATE AND METHODS OF MAKING SAME..... | 175 |
| COATED MICROSPHERES AND THEIR USE | 176 |
| ION-DETECTING MICROSPHERES | 176 |
| BIODEGRADABLE OXIDIZED CELLULOSE ESTERS AND THEIR USES AS MICROSPHERES..... | 176 |
| MONODISPERSE SILICA SPHERES CONTAINING POLYAMINE AND PROCESS FOR PRODUCING THE SAME..... | 177 |
| METHOD OF USING THERMAL INSULATION FLUID CONTAINING HOLLOW MICROSPHERES | 177 |
| METHOD OF MAKING STABLY PRESERVED MICROSPHERES IN LOWER ALCOHOL SOLVENT | 178 |
| ORAL-INTESTINAL VACCINES AGAINST DISEASES CAUSED BY ENTEROPATHIC ORGANISMS USING ANTIGENS | |

| | |
|---|-----|
| ENCAPSULATED WITHIN BIODEGRADABLE– BIOCOMPATIBLE MICROSPHERES..... | 178 |
| PROCESS OF FABRICATING METAL SPHERES..... | 178 |
| NANOPARTICLE COMPOSITE–COATED GLASS MICROSPHERES FOR USE IN BIOASSAYS..... | 179 |
| PROCESS AND APPARATUS FOR PRODUCING INORGANIC SPHERES | 179 |
| METHOD OF MAKING HOLLOW INORGANIC MICROSPHERES, AND PRODUCTS MADE THEREBY..... | 180 |
| PREPARATION OF SPHERES FOR DIAGNOSTIC TESTS..... | 180 |
| COMPOSITIONS COMPRISING MICROSPHERES WITH ANTI– INFLAMMATORY PROPERTIES FOR HEALING OF OCULAR TISSUES..... | 180 |
| METHOD OF MAKING POROUS MICROSPHERES WITH GEOMETRIC STANDARD DEVIATION OF 1.25 OR LESS..... | 181 |
| GLASS MICROSPHERES WITH MULTIPLE BUBBLE INCLUSIONS.... | 181 |
| METHOD OF PREPARING MIXED FORMULATION OF SUSTAINED RELEASE MICROSPHERES BY CONTINUOUS ONE–STEP PROCESS..... | 182 |
| PRODUCTION OF MICROSPHERES | 182 |
| ULTRA LOW DENSITY THERMALLY CLAD MICROSPHERES AND METHOD OF MAKING SAME | 182 |
| THERMO–EXPANSIVE MICROSPHERES, THEIR PRODUCTION PROCESS AND THEIR APPLICATION..... | 183 |
| INJECTABLE MICROSPHERES FOR TISSUE CONSTRUCTION..... | 184 |
| CATIONIC MICROSPHERES AND METHOD OF MAKING CATIONIC MICROSPHERES..... | 184 |
| COMPOSITIONS AND METHODS FOR BIODEGRADABLE MICROSPHERES AS CARRIERS OF BIOACTIVE SUBSTANCES | 184 |
| EMULSION/AGGREGATION POLYMERIC MICROSPHERES FOR BIOMEDICAL APPLICATIONS AND METHODS OF MAKING SAME | 185 |
| TRIGGERED RELEASE FROM PROTEINOID MICROSPHERES..... | 185 |
| FOAM INSULATION MADE WITH EXPANDABLE MICROSPHERES AND METHODS | 186 |
| ELECTROACTIVE MICROSPHERES AND METHODS..... | 186 |
| POLYMER MICROSPHERES CONTAINING LATENT COLORANTS AND METHOD OF PREPARATION..... | 186 |
| POLYMER MICROSPHERES CONTAINING ... (CONTINUED).... | 187 |