

# GLOBAL MARKETS FOR ROLL-TO-ROLL TECHNOLOGIES FOR FLEXIBLE DEVICES



SMC082A  
April 2013

Margareth Gagliardi  
*Project Analyst*

ISBN: 1-56965-245-7

**bcc** | Research  
Market Forecasting

**BCC Research**  
49 Walnut Park, Building 2  
Wellesley, MA 02481  
866-285-7215, 781-489-7301  
[www.bccresearch.com](http://www.bccresearch.com)  
Custom Reports:  
[carol.laverty@bccresearch.com](mailto:carol.laverty@bccresearch.com)

**TABLE OF CONTENTS**

<b>TOPIC</b>	<b>PAGE NO.</b>
CHAPTER 1 INTRODUCTION	2
STUDY GOALS AND OBJECTIVES	2
REASONS FOR DOING THIS STUDY	2
INTENDED AUDIENCE	3
SCOPE OF REPORT	4
METHODOLOGY AND INFORMATION SOURCES	5
RELATED BCC RESEARCH STUDIES	6
ANALYST CREDENTIALS	7
BCC ONLINE SERVICES	8
DISCLAIMER	8
CHAPTER 2 EXECUTIVE SUMMARY	10
<i>SUMMARY TABLE GLOBAL MARKET FOR FLEXIBLE DEVICES MANUFACTURED BY ROLL-TO-ROLL TECHNOLOGIES, THROUGH 2017 (\$ MILLIONS)</i>	11
<i>SUMMARY FIGURE GLOBAL MARKET FOR FLEXIBLE DEVICES MANUFACTURED BY ROLL-TO-ROLL TECHNOLOGIES, 2010-2017 (\$ MILLIONS)</i>	11
CHAPTER 3 OVERVIEW	13
INTRODUCTION	13
DEFINITION AND STUDY FOCUS	13
ROLL-TO-ROLL VERSUS BATCH PROCESSES	13
IMPORTANCE OF FLEXIBLE DEVICES AND R2R PROCESSES	14
HISTORY OF R2R FLEXIBLE DEVICES	15
<i>TABLE 1 R2R FLEXIBLE DEVICES—TECHNOLOGICAL MILESTONES</i>	15
<i>FIGURE 1 FLEXIBLE DEVICES - WORLDWIDE PATENT APPLICATIONS AND PATENTS ISSUED, 1970-2012</i>	16
CURRENT AND EMERGING FLEXIBLE DEVICES PRODUCED BY ROLL-TO-ROLL TECHNOLOGIES	17
<i>TABLE 2 FLEXIBLE DEVICES MANUFACTURED BY ROLL-TO-ROLL TECHNOLOGIES</i>	18
CIRCUIT DEVICES	18
Flexible Printed Circuits	18
Other Circuit Devices	19
OPTOELECTRONIC DEVICES	19
Displays	19
Polymer Dispersed Liquid Crystal Displays	19
Encapsulation	19
Phase Separation	20
Holography	20
Prefabricated Templates	20
Electrochromic Displays	21
Electrochromic Materials	21
Tungsten Oxide-based Electrochromic Devices	21
Electrophoretic Displays	22
Basic Design	22
Microcapsule Design	22
Organic Light-emitting Diode Displays	23

<b>TOPIC</b>	<b>PAGE NO.</b>
Basic Design	23
PHOTOVOLTAIC DEVICES	24
Solar Cells and Modules	24
SENSORS AND OTHER DEVICES	25
CHAPTER 4 ROLL-TO-ROLL TECHNOLOGIES	27
INTRODUCTION	27
BASIC ROLL-TO-ROLL FABRICATION PROCESS	27
<i>TABLE 3 BASIC ROLL-TO-ROLL FABRICATION STEPS</i>	28
SUBSTRATE SELECTION	28
FILM DEPOSITION AND PATTERNING	29
SUBTRACTIVE METHODS	29
Substrate Coating	29
<i>TABLE 4 THICK FILM COATING TECHNOLOGIES, 2013</i>	29
<i>TABLE 5 THIN FILM COATING TECHNOLOGIES, 2013</i>	31
Lithography	34
<i>TABLE 6 COMMON LITHOGRAPHIC METHODS, 2013</i>	34
Electron Beam Lithography	34
Scanning Probe Lithography	35
Dip-Pen Nanolithography	35
Nanoimprint	35
Thermoplastic Nanoimprint Lithography	35
Photo Nanoimprint Lithography	35
Laser-assisted Direct Imprint	36
Self-Aligned Imprint Lithography	36
Etching	36
ADDITIVE METHODS	36
<i>TABLE 7 R2R PRINTING TECHNOLOGIES</i>	37
MULTILAYER STRUCTURES	37
ASSEMBLY, CUTTING, TESTING AND PACKAGING	38
LATEST TECHNOLOGICAL DEVELOPMENTS FROM 2010 TO PRESENT	38
ROLL-TO-ROLL FABRICATION OF MEMS DISPLAYS	38
ELECTROPLATING SOLUTIONS FOR R2R FLEXIBLE SOLAR CELLS	39
PAPER-BASED ROLL-TO-ROLL SENSORS	40
POLYMERIC PRECURSORS FOR PRINTING THIN FILMS FOR SOLAR CELLS	40
RECHARGEABLE BATTERY BY ROLL-TO-ROLL PROCESS	41
MEMBRANES FOR HIGH-TEMPERATURE PEM FUEL CELLS	42
FLEXIBLE GRAPHENE SUPERCAPACITOR	42
RFID VAPOR SENSORS BY ROLL-TO-ROLL PROCESS	42
R2R MICROSTRUCTURED METAMATERIAL FILMS	43
HIGH-EFFICIENCY CIGS SOLAR CELLS BY ROLL-TO-ROLL PROCESS	43
LARGE AREA ATMOSPHERIC PRESSURE PECVD EQUIPMENT	44
OLED LIGHTING BY ROLL-TO-ROLL PROCESS	44
THIN FILM MEMORY BY ROLL-TO-ROLL PRINTING	44
ROLL-TO-ROLL PRINTING SYSTEM WITH MICRO-NOZZLES	45
HIGH-EFFICIENCY CIGS SOLAR CELLS ON PLASTIC SUBSTRATE	46
OTHER RELEVANT R&D ACTIVITIES	46

<b>TOPIC</b>	<b>PAGE NO.</b>
<i>TABLE 8 OTHER RELEVANT R &amp;D ACTIVITIES, 2013</i>	47
CHAPTER 5 GLOBAL MARKETS	49
ANALYSIS OUTLINE	49
GLOBAL MARKET SUMMARY	49
<i>TABLE 9 GLOBAL MARKET FOR R2R FLEXIBLE DEVICES, THROUGH 2017 (\$ MILLIONS)</i>	51
<i>FIGURE 2 GLOBAL MARKET FOR R2R FLEXIBLE DEVICES, 2010- 2017 (\$ MILLIONS)</i>	51
CURRENT MARKET STATUS	51
CURRENT MARKET SUMMARY	52
<i>TABLE 10 GLOBAL MARKET FOR R2R FLEXIBLE DEVICES, THROUGH 2012 (\$ MILLIONS)</i>	52
<i>FIGURE 3 GLOBAL MARKET FOR R2R FLEXIBLE DEVICES, 2010-2012 (\$ MILLIONS)</i>	52
REVENUES BY DEVICE TYPE	53
<i>TABLE 11 R2R FLEXIBLE DEVICES: GLOBAL REVENUES BY TYPE, THROUGH 2012 (\$ MILLIONS)</i>	53
<i>FIGURE 4 R2R FLEXIBLE DEVICES: MARKET SHARE BY TYPE, 2012 (%)</i>	53
REVENUES BY PROCESS	54
<i>TABLE 12 R2R FLEXIBLE DEVICES: GLOBAL REVENUES BY PROCESS, THROUGH 2012 (\$ MILLIONS)</i>	55
<i>FIGURE 5 R2R FLEXIBLE DEVICES: MARKET SHARE BY PROCESS, 2012 (%)</i>	55
REVENUES BY SUBSTRATE MATERIAL	56
<i>TABLE 13 R2R FLEXIBLE DEVICES: GLOBAL REVENUES BY SUBSTRATE MATERIAL, THROUGH 2012 (\$ MILLIONS)</i>	57
<i>FIGURE 6 R2R FLEXIBLE DEVICES: MARKET SHARE BY SUBSTRATE MATERIAL, 2012 (%)</i>	57
REVENUES BY REGION	58
<i>TABLE 14 R2R FLEXIBLE DEVICES: REVENUES BY REGION, THROUGH 2012 (\$ MILLIONS)</i>	58
<i>FIGURE 7 R2R FLEXIBLE DEVICES: MARKET SHARE BY REGION, 2012 (%)</i>	58
MARKET GROWTH TRENDS	59
INDUSTRY GROWTH AND TECHNOLOGICAL TRENDS	59
Semiconductors and Circuit Devices	59
<i>TABLE 15 FORECAST FOR SEMICONDUCTORS: REVENUES BY REGION THROUGH 2017 (\$ BILLIONS)</i>	60
Printed Circuit Boards and Flexible Circuits	60
Printed Electronics	61
Advanced Displays	61
<i>TABLE 16 FORECAST FOR ADVANCED DISPLAYS: GLOBAL REVENUES BY TYPE THROUGH 2017 (\$ BILLIONS)</i>	62
Paper-Thin, Touchscreen and Flexible Displays	62
Photovoltaic Cells	63
<i>TABLE 17 FORECAST FOR PHOTOVOLTAIC MODULE: GLOBAL PRODUCTION BY TYPE, THROUGH 2017 (MW)</i>	64
<i>FIGURE 8 PHOTOVOLTAIC MODULES: PRODUCTION SHARE BY TYPE, 2017 (%)</i>	64
Flexible Solar Cells	65
Sensors	65
<i>TABLE 18 SENSORS: GLOBAL REVENUES BY TYPE, THROUGH 2017 (\$MILLIONS)</i>	66
Flexible Sensors	66

<b>TOPIC</b>	<b>PAGE NO.</b>
Medical Electronics	66
<i>TABLE 19 FORECAST - MEDICAL ELECTRONICS: GLOBAL REVENUES BY SEGMENT, THROUGH 2017 (\$ BILLIONS)</i>	67
Portable and Wearable Medical Electronics	67
<i>TABLE 20 FORECAST - PORTABLE MEDICAL ELECTRONIC PRODUCTS: GLOBAL REVENUES BY SEGMENT, THROUGH 2017 (\$ BILLIONS)</i>	68
Emerging Markets	68
Supercapacitors	68
Fuel Cells	69
<i>TABLE 21 FORECAST FOR FUEL CELLS: GLOBAL REVENUES BY TYPE, THROUGH 2017 (\$MILLIONS)</i>	69
Batteries	69
MEMS and NEMS	70
<i>TABLE 22 FORECAST FOR MEMS AND NEMS: GLOBAL REVENUES BY TYPE, THROUGH 2017 (\$ BILLIONS)</i>	71
OTHER TECHNOLOGICAL TRENDS	71
Thin, Ultrathin and Flexible Devices	71
<i>TABLE 23 IC CONFIGURATIONS</i>	71
Roll-to-roll and Large Area Coatings	72
Merging of Thick and Thin Film Technologies	72
Energy and Environmental Factors	72
REGIONAL TRENDS	72
MARKET FORECAST	73
REVENUES BY DEVICE TYPE	73
<i>TABLE 24 FORECAST FOR R2R FLEXIBLE DEVICES: GLOBAL REVENUES BY TYPE, THROUGH 2017 (\$ MILLIONS)</i>	74
<i>FIGURE 9 FORECAST FOR R2R FLEXIBLE DEVICES: MARKET SHARE BY TYPE, 2017 (%)</i>	74
REVENUES BY PROCESS	75
<i>TABLE 25 FORECAST FOR R2R FLEXIBLE DEVICES: GLOBAL REVENUES BY PROCESS, THROUGH 2017 (\$ MILLIONS)</i>	75
<i>FIGURE 10 FORECAST FOR R2R FLEXIBLE DEVICES: MARKET SHARE BY PROCESS, 2017 (%)</i>	75
REVENUES BY SUBSTRATE MATERIAL	76
<i>TABLE 26 FORECAST FOR R2R FLEXIBLE DEVICES: GLOBAL REVENUES BY SUBSTRATE MATERIAL THROUGH 2017 (\$ MILLIONS)</i>	77
<i>FIGURE 11 FORECAST FOR R2R FLEXIBLE DEVICES: MARKET SHARE BY MATERIAL, 2017 (%)</i>	77
REVENUES BY REGION	78
<i>TABLE 27 FORECAST FOR R2R FLEXIBLE DEVICES: REVENUES BY REGION, THROUGH 2017 (\$ MILLIONS)</i>	78
<i>FIGURE 12 FORECAST FOR R2R FLEXIBLE DEVICES: MARKET SHARE BY REGION, 2017 (%)</i>	79
CHAPTER 6 GLOBAL INDUSTRY STRUCTURE	81
LEADING MANUFACTURERS OF FLEXIBLE DEVICES BY ROLL-TO-ROLL TECHNOLOGIES	81
<i>TABLE 28 LEADING MANUFACTURERS OF FLEXIBLE DEVICES BY ROLL-TO-ROLL TECHNOLOGIES, 2013</i>	81

<b>TOPIC</b>	<b>PAGE NO.</b>
<i>TABLE 29 LEADING MANUFACTURERS OF FLEXIBLE DEVICES BY ROLL-TO-ROLL TECHNOLOGIES, BY CATEGORY, 2013</i>	83
<i>TABLE 30 LEADING SUPPLIERS OF FLEXIBLE DEVICES BY ROLL-TO-ROLL TECHNOLOGIES, BY CATEGORY AND REGION, 2013</i>	85
LEADING PRODUCERS OF MATERIALS FOR FABRICATION OF FLEXIBLE DEVICES BY ROLL-TO-ROLL TECHNOLOGIES	85
<i>TABLE 31 LEADING PRODUCERS OF MATERIALS FOR FABRICATION OF R2R FLEXIBLE DEVICES, 2013</i>	85
OTHER PLAYERS IN THE ROLL-TO-ROLL INDUSTRY	86
<i>TABLE 32 OTHER RELEVANT INDUSTRY PLAYERS, 2013</i>	87
COMPANY PROFILES	91
3M	91
ACREO/PAPERDISPLAY	91
ASCENT SOLAR TECHNOLOGIES	92
AU OPTRONICS	93
AVERY DENNISON	94
CITALA	94
E INK HOLDINGS	95
E Ink Corporation	96
Acquisition of E Ink	96
EMFIT	97
FLEXIUM INTERCONNECT	98
FUJIKURA	99
GSI TECHNOLOGIES	99
KENT DISPLAYS	100
LINXENS	102
MATERION	103
MFLEX	104
MOLEX	105
MULTEK	105
NANOSOLAR	106
NIPPON MEKTRON, LTD.	106
NITTO DENKO	107
PARLEX	107
POWERFILM	108
SIPIX IMAGING	109
SUMITOMO ELECTRIC	109
ZHEN DING TECHNOLOGY	110
CHAPTER 7 U.S. PATENT ANALYSIS	112
INTRODUCTION	112
SUMMARY OF PATENTS AWARDED DURING THE PERIOD 2009 THROUGH 2012	112
<i>TABLE 33 R2R FLEXIBLE DEVICES - U.S. PATENTS, 2012</i>	112
<i>TABLE 34 R2R FLEXIBLE DEVICES - U.S. PATENTS, 2011</i>	114
<i>TABLE 35 R2R FLEXIBLE DEVICES - U.S. PATENTS, 2010</i>	115
<i>TABLE 36 R2R FLEXIBLE DEVICES - U.S. PATENTS, 2009</i>	116
GENERAL TRENDS	117
<i>TABLE 37 R2R FLEXIBLE DEVICES: U.S. PATENT TRENDS, 2009-2012</i>	117

<b>TOPIC</b>	<b>PAGE NO.</b>
<i>FIGURE 13 R2R FLEXIBLE DEVICES: U.S. PATENT TRENDS, 2009-2012 (NO. OF PATENTS)</i>	118
TRENDS BY COUNTRY AND REGION	118
<i>FIGURE 14 SHARES OF U.S. PATENTS RELATED TO R2R FLEXIBLE DEVICES BY REGION 2009-2012 (%)</i>	118
<i>TABLE 38 R2R FLEXIBLE DEVICES: PATENTS BY COUNTRY, 2009-2012 (%)</i>	120
PATENT TRENDS BY ASSIGNEE	120
<i>TABLE 39 ASSIGNEES OF U.S. PATENTS RELATED TO R2R FLEXIBLE DEVICES, THROUGH 2012</i>	121
<i>FIGURE 15 R2R FLEXIBLE DEVICES: SHARES OF U.S. PATENTS BY ORGANIZATION TYPE 2009-2012 (%)</i>	122
TRENDS BY PATENT CATEGORY	123
<i>FIGURE 16 R2R FLEXIBLE DEVICES: SHARES OF U.S. PATENTS BY CATEGORY, 2009-2012 (%)</i>	123
PATENT TRENDS BY PROCESS	124
<i>FIGURE 17 R2R FLEXIBLE DEVICES: SHARES OF U.S. PATENTS BY PROCESS, 2009-2012 (%)</i>	125
PATENT TRENDS BY DEVICE TYPE	126
<i>FIGURE 18 R2R FLEXIBLE DEVICES: SHARES OF U.S. PATENTS BY TYPE, 2009-2012 (%)</i>	126

**LIST OF TABLES**

<b>TABLE HEADING</b>	<b>PAGE NO.</b>
SUMMARY TABLE GLOBAL MARKET FOR FLEXIBLE DEVICES MANUFACTURED BY ROLL-TO-ROLL TECHNOLOGIES, THROUGH 2017 (\$ MILLIONS)	11
TABLE 1 R2R FLEXIBLE DEVICES—TECHNOLOGICAL MILESTONES	15
TABLE 2 FLEXIBLE DEVICES MANUFACTURED BY ROLL-TO-ROLL TECHNOLOGIES	18
TABLE 3 BASIC ROLL-TO-ROLL FABRICATION STEPS	28
TABLE 4 THICK FILM COATING TECHNOLOGIES, 2013	29
TABLE 5 THIN FILM COATING TECHNOLOGIES, 2013	31
TABLE 6 COMMON LITHOGRAPHIC METHODS, 2013	34
TABLE 7 R2R PRINTING TECHNOLOGIES	37
TABLE 8 OTHER RELEVANT R &D ACTIVITIES, 2013	47
TABLE 9 GLOBAL MARKET FOR R2R FLEXIBLE DEVICES, THROUGH 2017 (\$ MILLIONS)	51
TABLE 10 GLOBAL MARKET FOR R2R FLEXIBLE DEVICES, THROUGH 2012 (\$ MILLIONS)	52
TABLE 11 R2R FLEXIBLE DEVICES: GLOBAL REVENUES BY TYPE, THROUGH 2012 (\$ MILLIONS)	53
TABLE 12 R2R FLEXIBLE DEVICES: GLOBAL REVENUES BY PROCESS, THROUGH 2012 (\$ MILLIONS)	55
TABLE 13 R2R FLEXIBLE DEVICES: GLOBAL REVENUES BY SUBSTRATE MATERIAL, THROUGH 2012 (\$ MILLIONS)	57
TABLE 14 R2R FLEXIBLE DEVICES: REVENUES BY REGION, THROUGH 2012 (\$ MILLIONS)	58
TABLE 15 FORECAST FOR SEMICONDUCTORS: REVENUES BY REGION THROUGH 2017 (\$ BILLIONS)	60
TABLE 16 FORECAST FOR ADVANCED DISPLAYS: GLOBAL REVENUES BY TYPE THROUGH 2017 (\$ BILLIONS)	62
TABLE 17 FORECAST FOR PHOTOVOLTAIC MODULE: GLOBAL PRODUCTION BY TYPE, THROUGH 2017 (MW)	64
TABLE 18 SENSORS: GLOBAL REVENUES BY TYPE, THROUGH 2017 (\$MILLIONS)	66
TABLE 19 FORECAST - MEDICAL ELECTRONICS: GLOBAL REVENUES BY SEGMENT, THROUGH 2017 (\$ BILLIONS)	67
TABLE 20 FORECAST - PORTABLE MEDICAL ELECTRONIC PRODUCTS: GLOBAL REVENUES BY SEGMENT, THROUGH 2017 (\$ BILLIONS)	68
TABLE 21 FORECAST FOR FUEL CELLS: GLOBAL REVENUES BY TYPE, THROUGH 2017 (\$MILLIONS)	69
TABLE 22 FORECAST FOR MEMS AND NEMS: GLOBAL REVENUES BY TYPE, THROUGH 2017 (\$ BILLIONS)	71
TABLE 23 IC CONFIGURATIONS	71
TABLE 24 FORECAST FOR R2R FLEXIBLE DEVICES: GLOBAL REVENUES BY TYPE, THROUGH 2017 (\$ MILLIONS)	74
TABLE 25 FORECAST FOR R2R FLEXIBLE DEVICES: GLOBAL REVENUES BY PROCESS, THROUGH 2017 (\$ MILLIONS)	75
TABLE 26 FORECAST FOR R2R FLEXIBLE DEVICES: GLOBAL REVENUES BY SUBSTRATE MATERIAL THROUGH 2017 (\$ MILLIONS)	77
TABLE 27 FORECAST FOR R2R FLEXIBLE DEVICES: REVENUES BY REGION, THROUGH 2017 (\$ MILLIONS)	78
TABLE 28 LEADING MANUFACTURERS OF FLEXIBLE DEVICES BY ROLL-TO-ROLL TECHNOLOGIES, 2013	81
TABLE 29 LEADING MANUFACTURERS OF FLEXIBLE DEVICES BY ROLL-TO-ROLL TECHNOLOGIES, BY CATEGORY, 2013	83



---

<b>TABLE HEADING</b>	<b>PAGE NO.</b>
TABLE 30 LEADING SUPPLIERS OF FLEXIBLE DEVICES BY ROLL-TO-ROLL TECHNOLOGIES, BY CATEGORY AND REGION, 2013	85
TABLE 31 LEADING PRODUCERS OF MATERIALS FOR FABRICATION OF R2R FLEXIBLE DEVICES, 2013	85
TABLE 32 OTHER RELEVANT INDUSTRY PLAYERS, 2013	87
TABLE 33 R2R FLEXIBLE DEVICES - U.S. PATENTS, 2012	112
TABLE 34 R2R FLEXIBLE DEVICES - U.S. PATENTS, 2011	114
TABLE 35 R2R FLEXIBLE DEVICES - U.S. PATENTS, 2010	115
TABLE 36 R2R FLEXIBLE DEVICES - U.S. PATENTS, 2009	116
TABLE 37 R2R FLEXIBLE DEVICES: U.S. PATENT TRENDS, 2009-2012	117
TABLE 38 R2R FLEXIBLE DEVICES: PATENTS BY COUNTRY, 2009-2012 (%)	120
TABLE 39 ASSIGNEES OF U.S. PATENTS RELATED TO R2R FLEXIBLE DEVICES, THROUGH 2012	121

**LIST OF FIGURES**

<b>FIGURE TITLE</b>	<b>PAGE NO.</b>
SUMMARY FIGURE GLOBAL MARKET FOR FLEXIBLE DEVICES MANUFACTURED BY ROLL-TO-ROLL TECHNOLOGIES, 2010-2017 (\$ MILLIONS)	11
FIGURE 1 FLEXIBLE DEVICES - WORLDWIDE PATENT APPLICATIONS AND PATENTS ISSUED, 1970-2012	16
FIGURE 2 GLOBAL MARKET FOR R2R FLEXIBLE DEVICES, 2010- 2017 (\$ MILLIONS)	51
FIGURE 3 GLOBAL MARKET FOR R2R FLEXIBLE DEVICES, 2010-2012 (\$ MILLIONS)	52
FIGURE 4 R2R FLEXIBLE DEVICES: MARKET SHARE BY TYPE, 2012 (%)	53
FIGURE 5 R2R FLEXIBLE DEVICES: MARKET SHARE BY PROCESS, 2012 (%)	55
FIGURE 6 R2R FLEXIBLE DEVICES: MARKET SHARE BY SUBSTRATE MATERIAL, 2012 (%)	57
FIGURE 7 R2R FLEXIBLE DEVICES: MARKET SHARE BY REGION, 2012 (%)	58
FIGURE 8 PHOTOVOLTAIC MODULES: PRODUCTION SHARE BY TYPE, 2017 (%)	64
FIGURE 9 FORECAST FOR R2R FLEXIBLE DEVICES: MARKET SHARE BY TYPE, 2017 (%)	74
FIGURE 10 FORECAST FOR R2R FLEXIBLE DEVICES: MARKET SHARE BY PROCESS, 2017 (%)	75
FIGURE 11 FORECAST FOR R2R FLEXIBLE DEVICES: MARKET SHARE BY MATERIAL, 2017 (%)	77
FIGURE 12 FORECAST FOR R2R FLEXIBLE DEVICES: MARKET SHARE BY REGION, 2017 (%)	79
FIGURE 13 R2R FLEXIBLE DEVICES: U.S. PATENT TRENDS, 2009-2012 (NO. OF PATENTS)	118
FIGURE 14 SHARES OF U.S. PATENTS RELATED TO R2R FLEXIBLE DEVICES BY REGION 2009-2012 (%)	118
FIGURE 15 R2R FLEXIBLE DEVICES: SHARES OF U.S. PATENTS BY ORGANIZATION TYPE 2009-2012 (%)	122
FIGURE 16 R2R FLEXIBLE DEVICES: SHARES OF U.S. PATENTS BY CATEGORY, 2009-2012 (%)	123
FIGURE 17 R2R FLEXIBLE DEVICES: SHARES OF U.S. PATENTS BY PROCESS, 2009-2012 (%)	125
FIGURE 18 R2R FLEXIBLE DEVICES: SHARES OF U.S. PATENTS BY TYPE, 2009-2012 (%)	126