

# ADVANCED BATTERY & CAPACITOR PATENT EDGE

Q1 2016 UPDATE: JULY 27, 2016

# ABC PatentEdge Quarterly Report

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## What is Advanced Battery & Capacitor PatentEdge™?

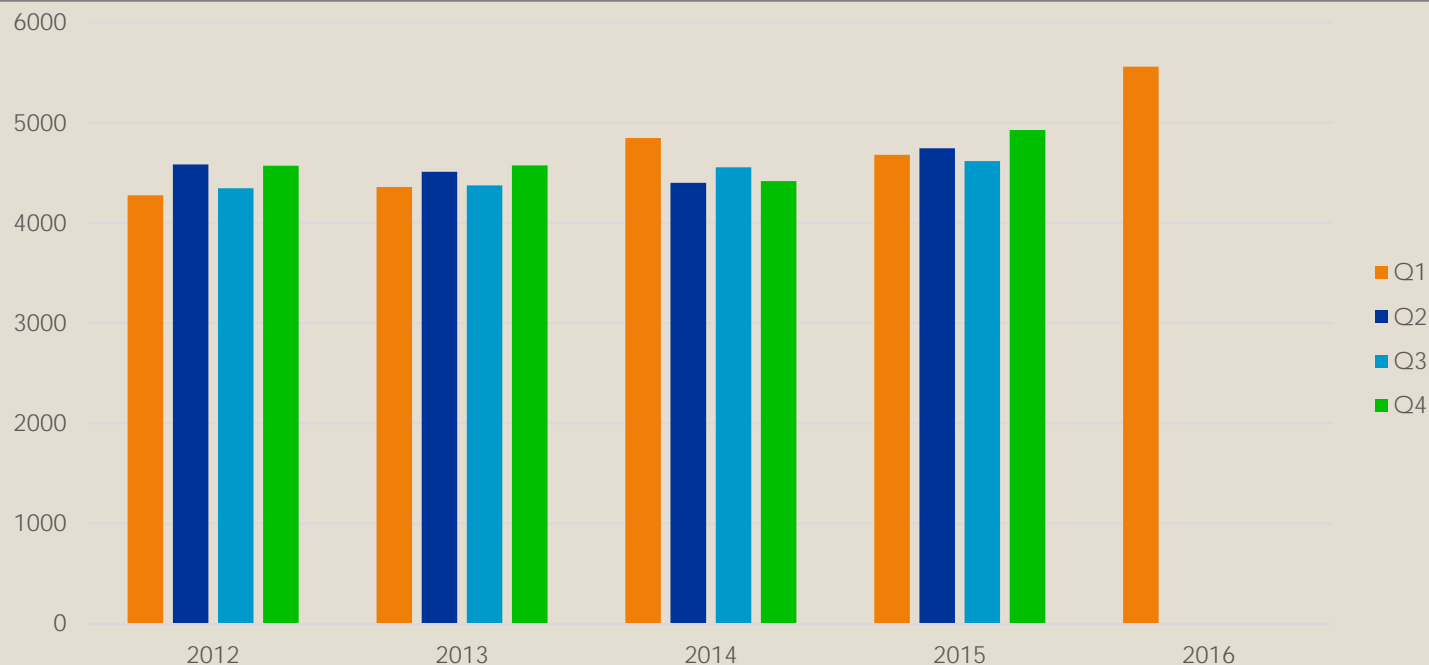
[ABC PatentEdge](#) is the only competitive patent intelligence solution specifically designed for the Advanced Battery market.

The ABC PatentEdge contains six high-level battery technology categories, developed by IP Checkups' along with industry leading battery technology experts. Within these six categories, there are 200+ technology and market-related sub-categories containing more than 250,000 patents published from worldwide\* patenting authorities.

- Purpose:** The [ABC PatentEdge Quarterly](#) was developed to provide insight into recent advanced battery industry patent activity. As part of our partnership, IP Checkups provides this quarterly report to NAATBatt members as an exclusive value-add.
- Methodology:** The [ABC PatentEdge Quarterly](#) utilizes data from the [ABC PatentEdge](#) database to report on advanced battery trends and recent patent filing activity in specific battery technology areas.
- Sources:** Statistics reported in the [ABC PatentEdge Quarterly](#) were derived from the [ABC PatentEdge](#) database, which houses over 250,000 battery-related patents from the U.S. Patent & Trademark Office, the World Intellectual Property Organization, the European Patent Office.

\*Worldwide = U.S. Published Applications, U.S. Granted Patents, European (EP) Published applications, European (EP) Granted Patents, World Intellectual Property Organization (WO) Published Applications

# Worldwide Quarterly Patent Activity: 2012-2016

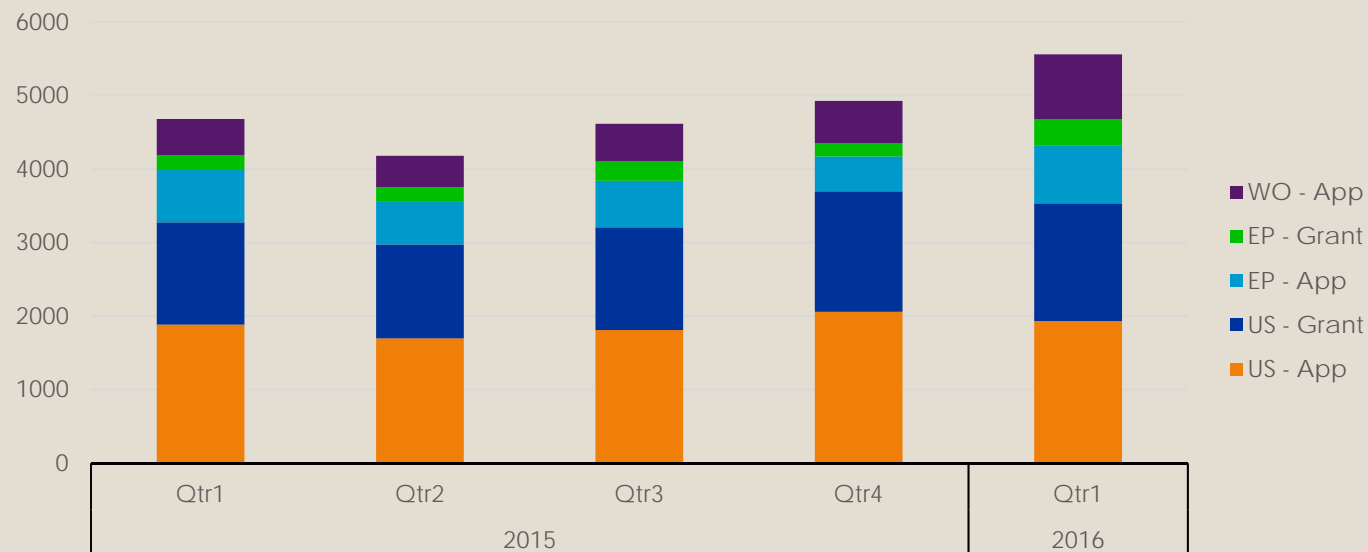


According to ABC PatentEdge data, the number of new worldwide patent publications in Q1 2016 increased by 18.8% compared with the same period in 2015.

\*Worldwide = U.S. published applications, U.S. granted patents, European (EP) published applications, European (EP) granted patents, World Intellectual Property Organization (WO) published applications

# Worldwide Patent Publications: Q4 2014 – Q4 2015

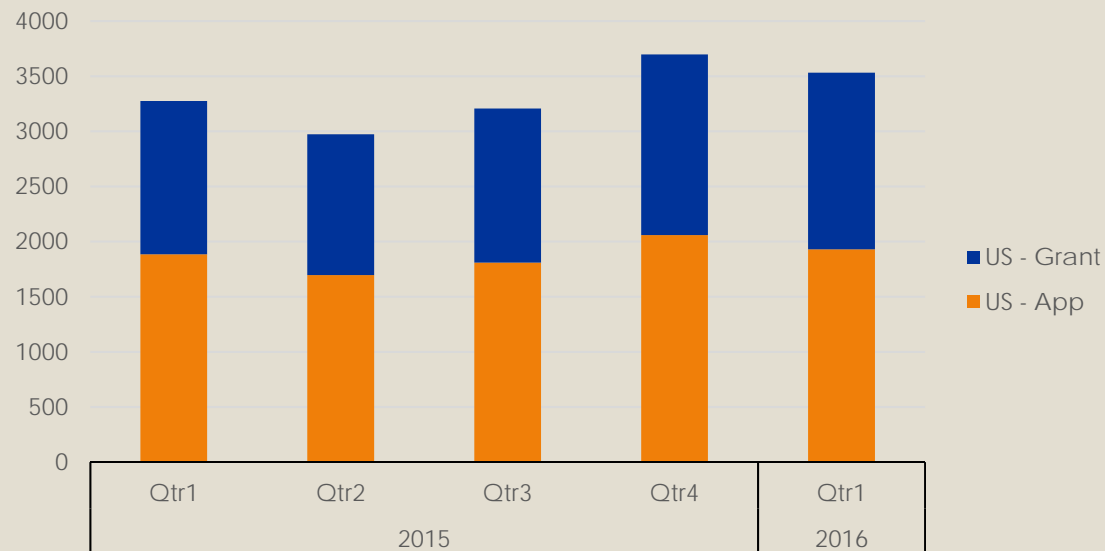
Total worldwide\* patent publications in advanced battery technology increased by 12.8 % from Q4 2015 to Q1 2016.



\*Worldwide = U.S. published applications, U.S. granted patents, European (EP) published applications, European (EP) granted patents, World Intellectual Property Organization (WO) published applications

# U.S. Patent Publications: Q1 2015 – Q1 2016

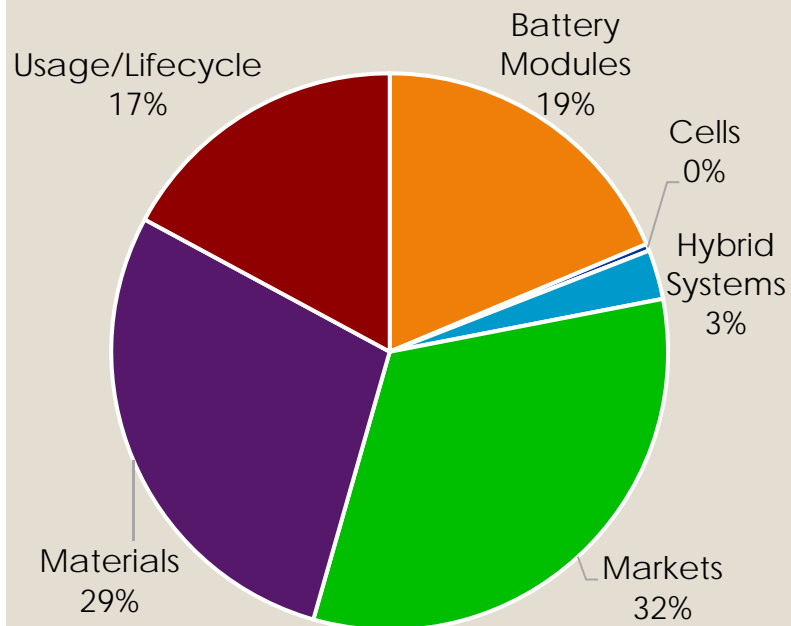
From Q4 2015 to Q1 2016, both published U.S. patent applications and granted patents in advanced batteries decreased by 6% and 2% respectively.





# Patent Activity in Key Battery Technology Sectors

# Worldwide Patent Publications in Battery Sectors: Q1 2016



	EP			US			WO	Total
	App	Grant	Total	App	Grant	Total	App	
Battery Modules	162	75	237	444	389	833	159	<b>1229</b>
Cells	3	2	5	6	7	13	8	<b>26</b>
Hybrid Systems	29	12	41	72	49	121	27	<b>189</b>
Markets	312	147	459	711	649	1360	316	<b>2135</b>
Materials	277	123	400	634	499	1133	339	<b>1872</b>
Usage/Lifecycle	152	48	200	444	296	740	186	<b>1126</b>
<b>Total</b>	<b>935</b>	<b>407</b>	<b>1342</b>	<b>2311</b>	<b>1889</b>	<b>4200</b>	<b>1035</b>	<b>6577</b>






In Q1 2016, the Materials sector posted the largest increase at 10% over last quarter, while the Battery Modules sector shows a 14% decrease. Hybrid Systems, Markets, and Usage/Lifestyle also posted slight decreases over Q4 2015.

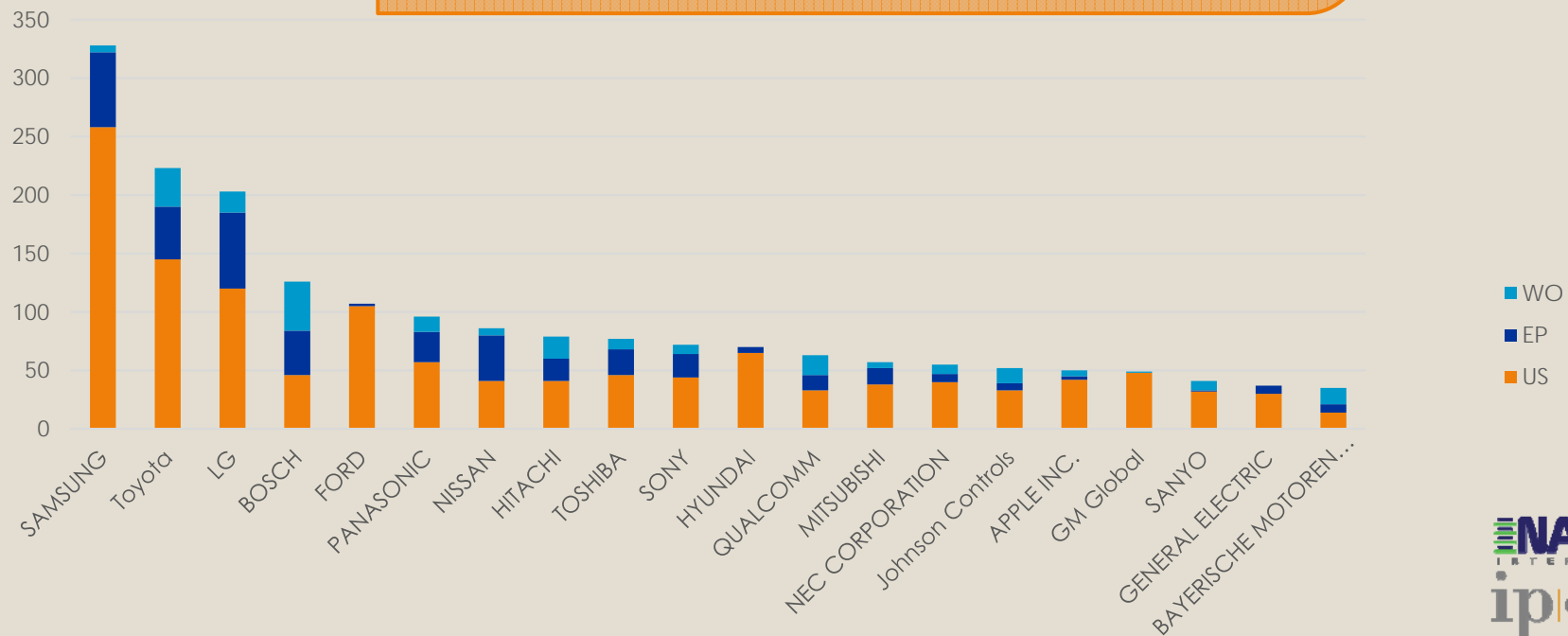
\*Patents may appear in multiple categories in chart above.

# Top Innovators



# Top 20 Assignees Q1 2016: Worldwide Patent Publications

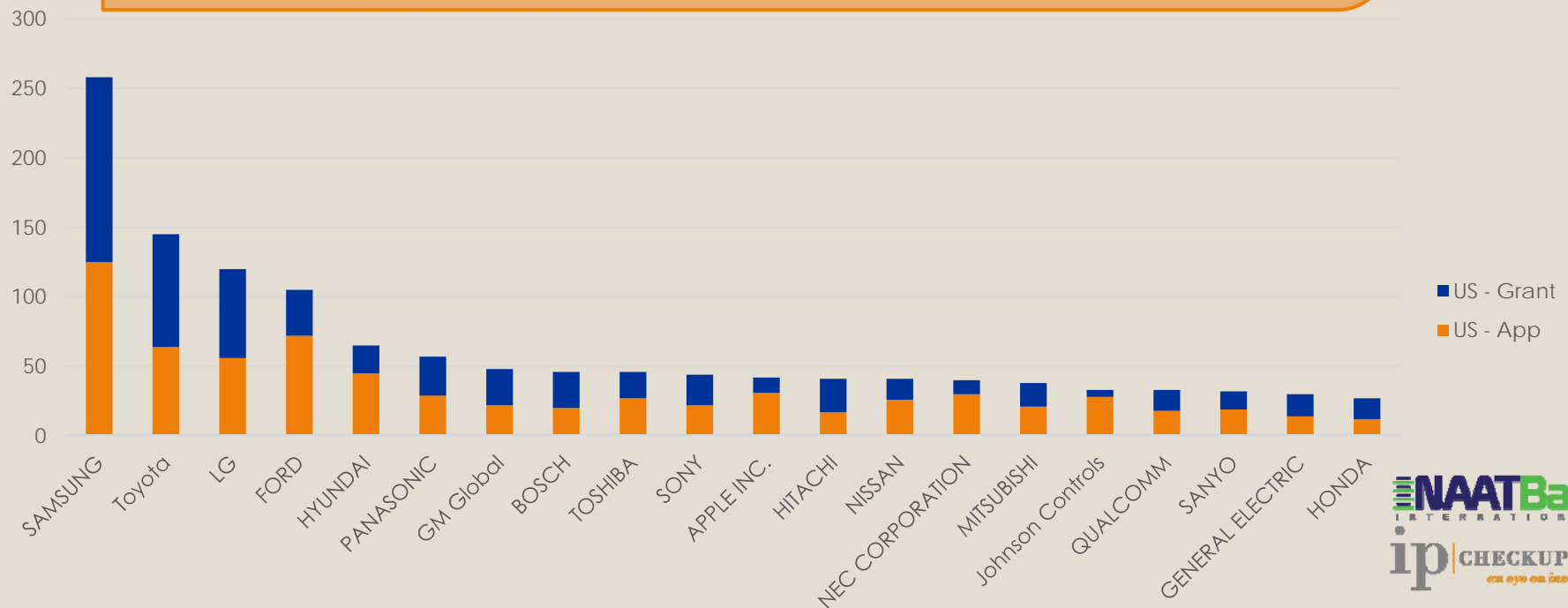
 In Q1 2016, Samsung, Toyota & LG continued to be the top innovators.  
 New Assignees in the top 20 for Q1 2016:  
 Apple  
 GE  
 Bayerische Motoren AG



# Top 20 Assignees Q1 2016: U.S. Applications vs. Grants



In Q1 2016, Samsung regains top spot for US filings and grants with nearly double Toyota's numbers, after Toyota led in the previous quarter. Most of the top 20 US filers are Asian automobile and consumer electronics companies, with notable exceptions being US-based General Motors, General Electric, and Johnson Controls



# Active Academic & Research Institutions: Q1 2016

Academic Institution	Count
INDUSTRY-UNIVERSITY COOPERATION FOUNDATION	13
HANYANG UNIVERSITY	9
UNIVERSITY OF CALIFORNIA	6
TSINGHUA UNIVERSITY	4
ARIZONA STATE UNIVERSITY	4
UNIVERSITY OF HOUSTON SYSTEM	4
PRESIDENT AND FELLOWS OF HARVARD COLLEGE	4
Leland Stanford Junior University	4
UNIVERSITY OF MICHIGAN	3
KYUSHU UNIVERSITY	3
University of Texas	3
NATIONAL UNIVERSITY OF SINGAPORE	3
UNIVERSITY OF MARYLAND COLLEGE PARK	3
CASE WESTERN RESERVE UNIVERSITY	3
University of North Carolina at Chapel Hill	3
Board of Trustees of the Leland Stanford Junior University	3
KANSAS STATE UNIVERSITY RESEARCH FOUNDATION	3
RAMOT AT TEL AVIV UNIVERSITY LTD	3

Research Institution	Count
BATTELLE MEMORIAL INSTITUTE	13
UCHICAGO ARGONNE LLC	9
Palo Alto Research Center Incorporated	7
KOREA ELECTRONICS TECHNOLOGY INSTITUTE	7
Industrial Technology Research Institute	7
KOREA INSTITUTE OF ENERGY RESEARCH	5
Electronics & Telecom. Research Inst.	5
Amtek Research International LLC.	3
Hong Kong Applied Science and Technology Research Institute Co. Ltd.	3
Council of Industrial & Scientific Research	3
Institute of Nuclear Energy Research	3
National Institute of Advanced Industrial Science and Technology	2
The Swatch Group Research and Development Ltd.	2
KOREA ADVANCED INSTITUTE OF SCIENCE AND TECHNOLOGY	4
KOREA INSTITUTE OF INDUSTRIAL TECHNOLOGY	2
LAWRENCE LIVERMORE NATIONAL SECURITY	2
National Institute For Materials Science	2

These academic universities and research institutions were the leaders in advanced battery related published patent applications during Q1'16.

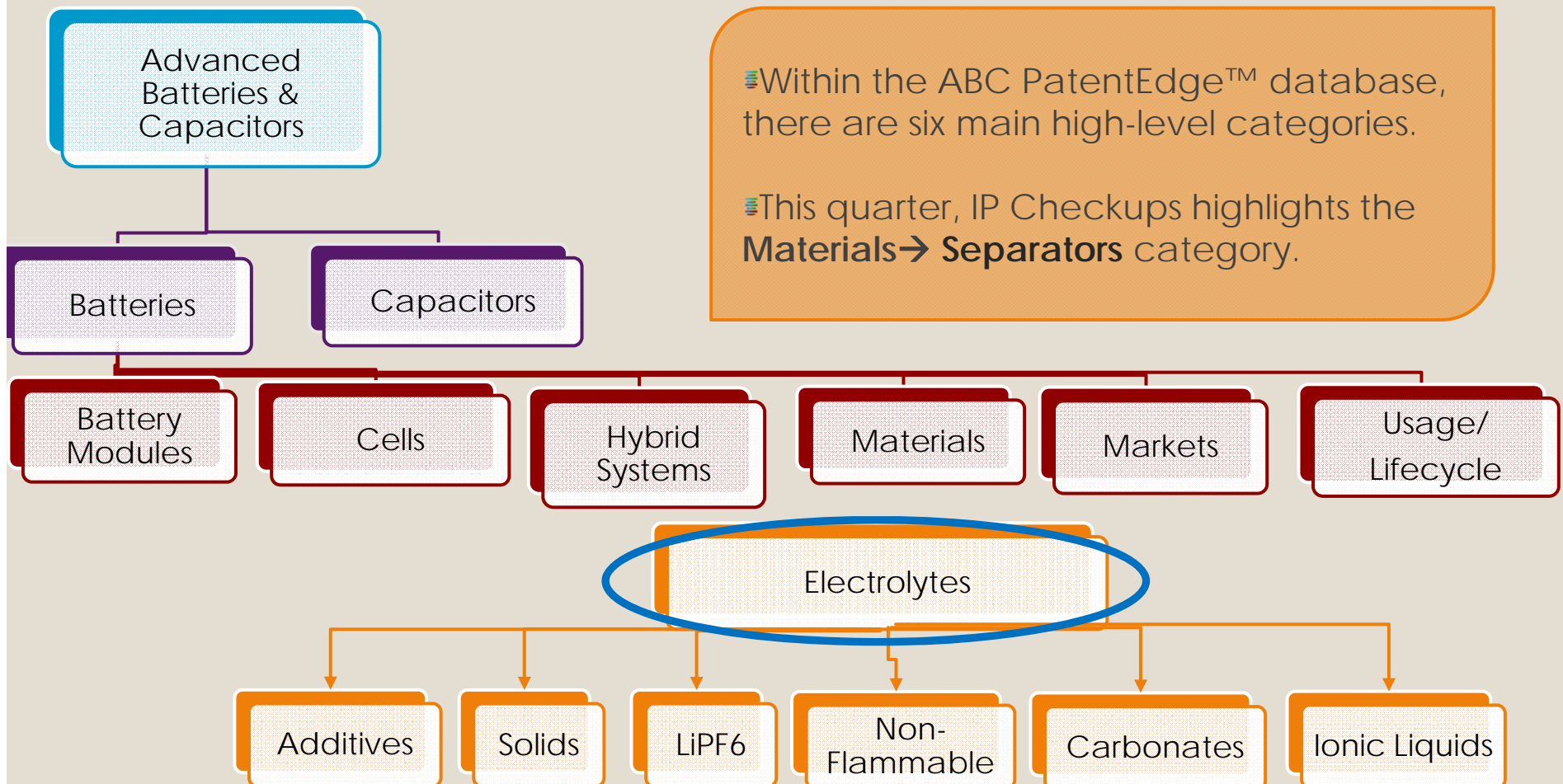
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# Spotlight on Electrolytes

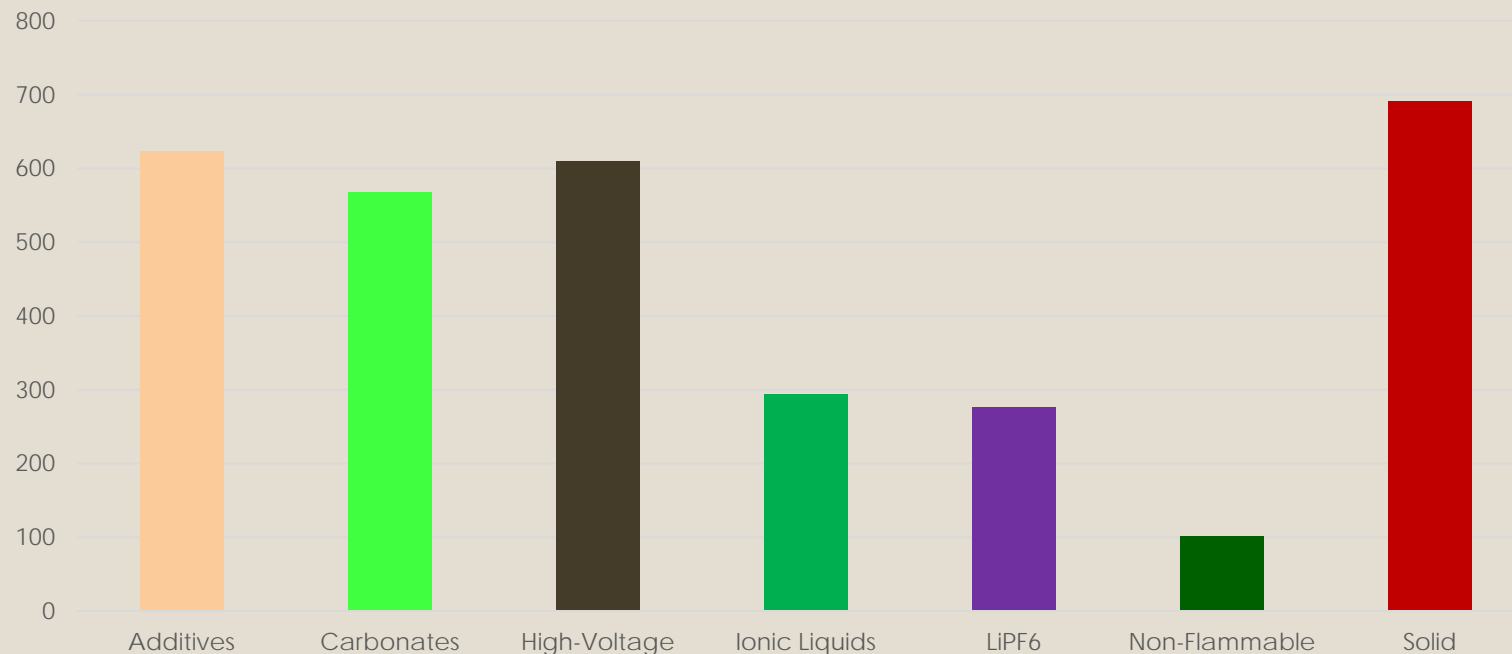
# ABC PatentEdge Hierarchy

Within the ABC PatentEdge™ database, there are six main high-level categories.

This quarter, IP Checkups highlights the **Materials** → **Separators** category.



# Patent Activity By Electrolytes Sub-categories



- In Q1 2016, there were 491\* worldwide\*\* patent documents directed to separator technology, which is only a 1% decrease from Q4 2015.
- Most publications occurred in the Solids subgroup, with Additives, Carbonates, and High-Voltage subgroups closely behind.

\*400 unique patent documents published, however, patents may appear in multiple categories in chart above.

\*\*Worldwide = U.S. published applications, U.S. granted patents, European (EP) published applications, European (EP) granted patents, World Intellectual Property Organization (WO) published applications

# Top Assignees and Inventors in Electrolytes – Q1 2016

Below is a list of the most prolific companies and inventors in Separators, based on worldwide\* published patent applications in Q1 2016.

Inventor (Assignee)	#
Kwon, Yo-Han (LG)	23
KATO, Yuki (Toyota)	8
ABE, Koji (Ube Industries)	7
Christensen, John F. (Bosch)	7
OHTOMO, Takamasa (Toyota)	7
MITCHELL, William (Merck)	6
Friesen, Cody A. (Fluidic Inc., AZ State Univ.)	6
Blouin, Nicolas (Merck)	6
IHARA, Masayuki (Sony)	6
He, Hui (Nanotek Instruments)	6
Holme, Tim (Quantumscape Corp.)	6

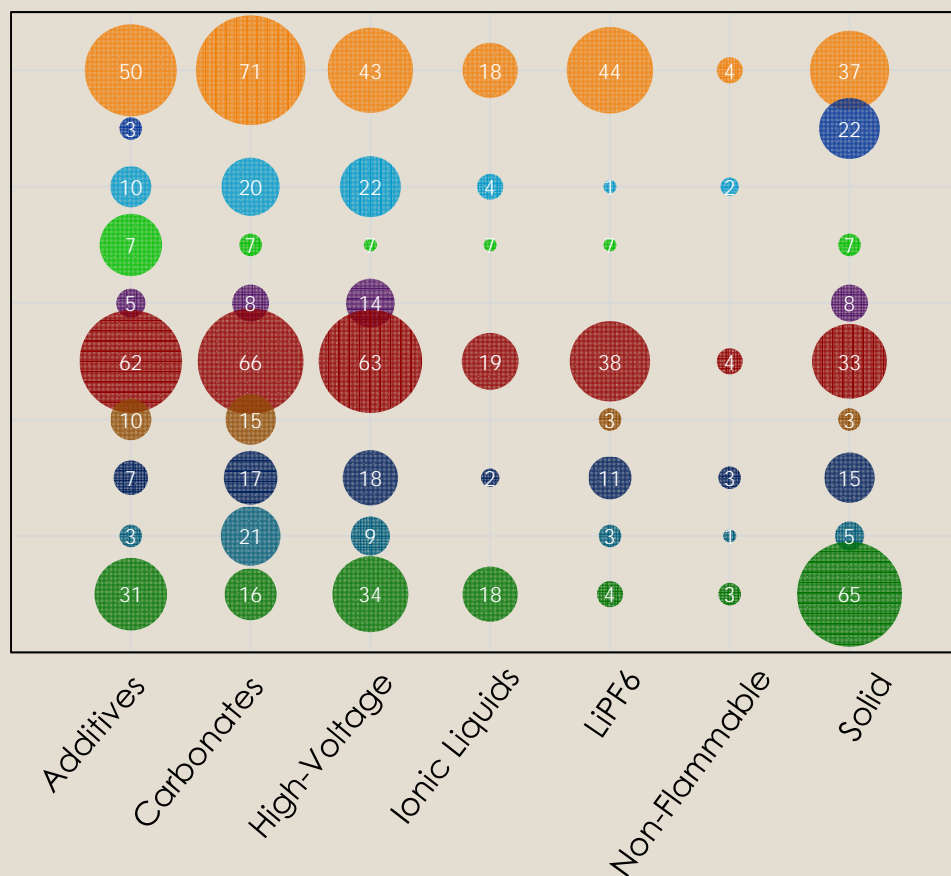


\*Worldwide = U.S. published applications, U.S. granted patents, European (EP) published applications, European (EP) granted patents, World Intellectual Property Organization (WO) published applications

# Top Assignees in Electrolytes by Category

Top assignees LG, Samsung, and Toyota published in each Electrolytes Subcategory.

Among all top assignees, there is a clear focus on Additives, Carbonates, High-Voltage, and Solid Electrolytes.



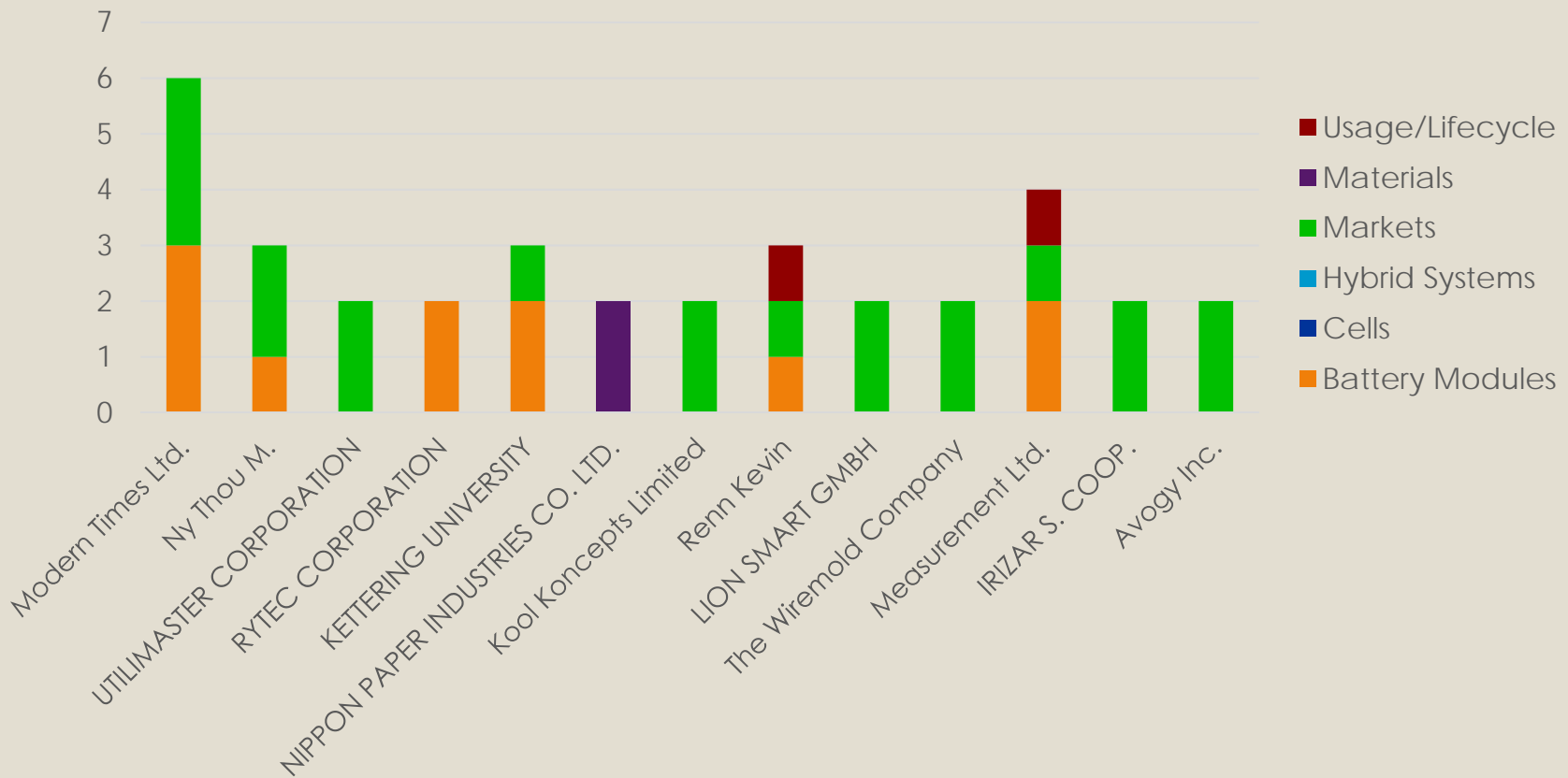
- LG
- MERCK PATENT GMBH
- MITSUBISHI
- NISSAN
- PANASONIC
- SAMSUNG
- SANYO
- SONY
- TOSHIBA

\*Patents may appear in multiple categories within sub-collections of a battery sector.

\*\*Worldwide = U.S. published applications, U.S. granted patents, European (EP) published applications, European (EP) granted patents, World Intellectual Property Organization (WO) published applications



# Batteries: New Entrants by Category



This chart shows all assignees with more than one new publications in the **Battery** category in Q1 2016. These assignees have had zero publications in the same category since at least Q4 2010.

# Q1 2016 Advanced Battery Summary

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- New worldwide\* patent publications in Q1 2016 increased by 18.8% compared with the same period in 2015.
- Total worldwide\* patent publications in advanced battery technology increased by 12.8 % from Q4 2015 to Q1 2016.
- From Q4 2015 to Q1 2016, both published U.S. patent applications and granted patents in advanced batteries decreased by 6% and 2% respectively.
- In Q1 2016, Samsung, Toyota & LG continued to be the top innovators, while Apple, GE joined the group of top assignees.
- Toyota, LG, and Samsung also dominated in Battery Electrolytes innovations this quarter
- Among all top assignees in Battery Electrolytes, there is a clear focus on Additives, Carbonates, High-Voltage, and Solid Electrolytes.

\*Worldwide = U.S. published applications, U.S. granted patents, European (EP) published applications, European (EP) granted patents, World Intellectual Property Organization (WO) published applications

# With ABC PatentEdge...

- Track worldwide patent filing, publication and issuance trends in more than 200 advanced battery related tech categories
- Identify which patents have been assigned to which companies
- Learn what trends within specific technologies are developing
- Identify key thought leaders in different technical areas
- Review patent activity coming from universities and research institutions filing patents in particular technology areas
- Find out where leading companies are really making their bets

## Want More?

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# Appendix

# Patent-101:



## PATENT FACTS:

- Patent applications typically publish within 18 months of their filing date
- In the U.S. & in Europe, patents usually issue within 3-5 years
- The World Intellectual Property Organization (WO) is a publication authority only. Patents filed in the WO never issue.

## KEY TERMINOLOGY:

- Assignee:** The person or entity who owns the patent or patent application in question. Ownership of a patent document may be shared or transferred, on multiple occasions and/or among multiple parties.
- Patent Application:** A formal application for a patent. This classification includes all types of patent applications (i.e., utility, design, plant, and reissue) except provisional patent applications. The non-provisional application establishes the filing date and initiates the examination process. A non-provisional utility patent application must include a specification, including a claim or claims; drawings, when necessary; an oath or declaration; and the prescribed filing fee.
- Granted/Issued Patent:** Once the patent application complies with the requirements of the relevant patent office, a property right is granted to an inventor "to exclude others from making, using, offering for sale, or selling the invention or importing the invention" into a specific country for a limited time in exchange for public disclosure of the invention when the patent is granted.
- Patent Document/Patent Publication:** Blanket terms used to describe a group of publicly available documents that includes both issued patents & published patent applications



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