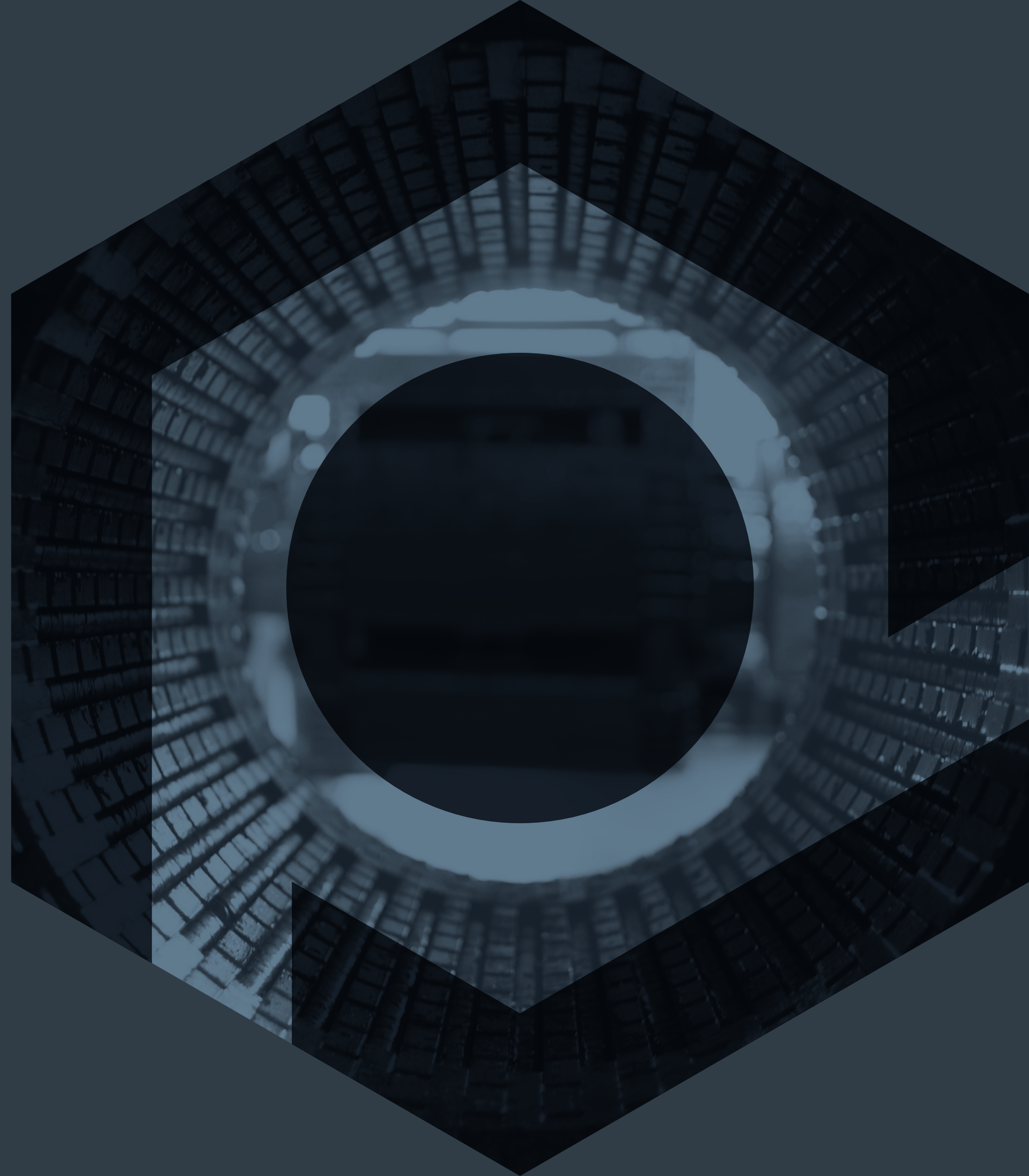




# WHAT CAN PATENT TRENDS TEACH US ABOUT BATTERY TECHNOLOGY?

POTTERCLARKSON.COM







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**Battery technology has enjoyed a spike in technological advancements over the past decade. While this is largely due to the rise in demand for electric vehicles and high-powered consumer electronics, current patent filing trends suggest there is more to it, signposting where innovation and investment are most likely to be found as the sector continues to evolve.**

If we go back to basics, patent applications are classified by their subject matter. This not only enables patent office examiners to check if the claims of a newly filed patent application are novel and sufficiently inventive for a patent to be granted, it also makes spotting patent filing trends easier.

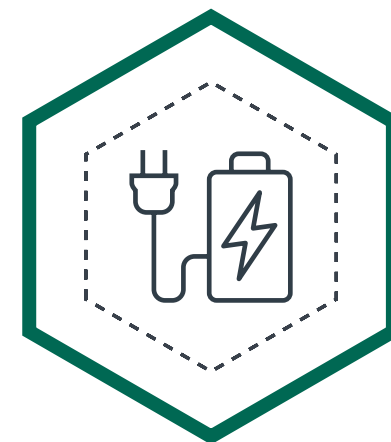
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## WHAT HAVE WE LEARNED ABOUT PATENT TRENDS IN BATTERY TECHNOLOGY?

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Looking specifically at battery technology, the patent classification system allows us to look at a range of patents covering:



**(H01M 10/44)**  
Methods for charging or discharging secondary cells



**(H01M 10/54)**  
Reclaiming serviceable parts of waste accumulators



**(H01M 10/60)**  
Secondary cells—heating or cooling; temperature control



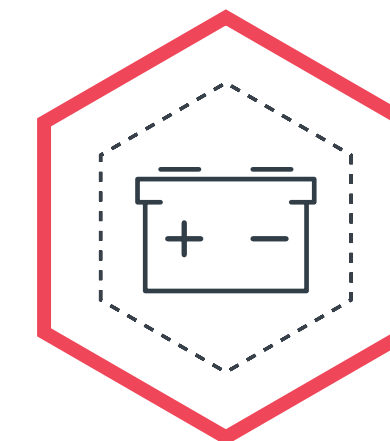
**(H01M 10/623)**  
Cells specifically for portable devices



**(H01M 10/625)**  
Cells specifically for vehicles



**(H01M 4/02)**  
Electrodes composed of, or comprising, an active material



**(H01M 10/052)**  
Li-accumulators



**(H01M 10/056)**  
Accumulators with non-aqueous electrolyte characterised by the materials used as the electrolyte

If we start by looking Figure 1, we can see the number of patent applications filed per year across the world within these different patent classifications up until 2019 (the last year with complete data).

This clearly shows that, since 2009 in particular, there has been an overall increase in all the technical areas linked to battery technology.

The biggest rises have been in the fields of cells specifically for vehicles and lithium technology in general. However, although the number of filings is much lower in absolute terms, patent applications focused on the reclaiming of serviceable parts of waste accumulators have seen a five-fold rise since 2010.

However, there have been drops in other areas.

Filings involving heating or cooling control have fallen since 2013 and applications related to charging and discharging are yet to exceed the peak number of filings set in 2011. Does this mean many of the major innovations in these areas have already arrived for the current generation of batteries?

The reasons for changes in the number of patent filings are complex. The general economic climate, fluctuations in research grants and available funding and a shift in the resources required to support a product at specific stages in its life-cycle all play a part in a company's IP budget.

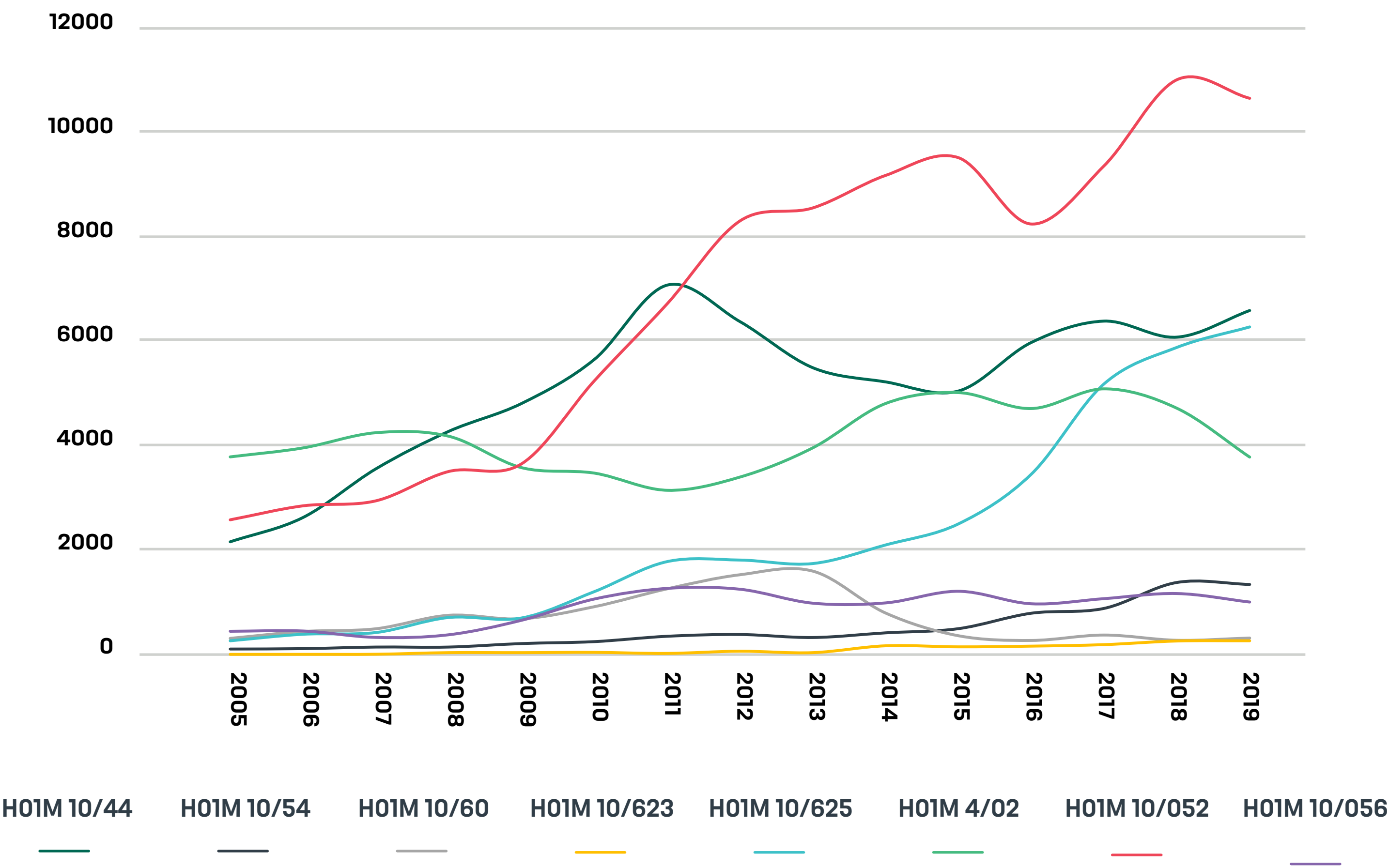


Fig. 1 - Patent applications filed in different technology classifications between 2005 and 2019.



# MATURING VS EMERGING TECHNOLOGIES

Filing a patent application does not necessarily mean it will meet the required standards of novelty and inventiveness.

Figure 2 shows the number of patents granted each year in the different classifications. However, as it typically takes three to five years for a patent application to progress to grant, we would expect to see an offset between changes in the respective filing and grant statistics featured in Figures 1 and 2.

As with patent filings, the number of patents being granted has increased since 2010–2013, particularly for cells for vehicles. However, there are some differences to note.

For example, while we can see patent filings in the field of charging and discharging control has fallen and then been stagnant, the number of patents being granted continues to increase steadily. Similarly, when looking at lithium accumulator technology in general, the number of filings has been variable but the number of patents granted is steadily increasing. This may be due to better innovation.

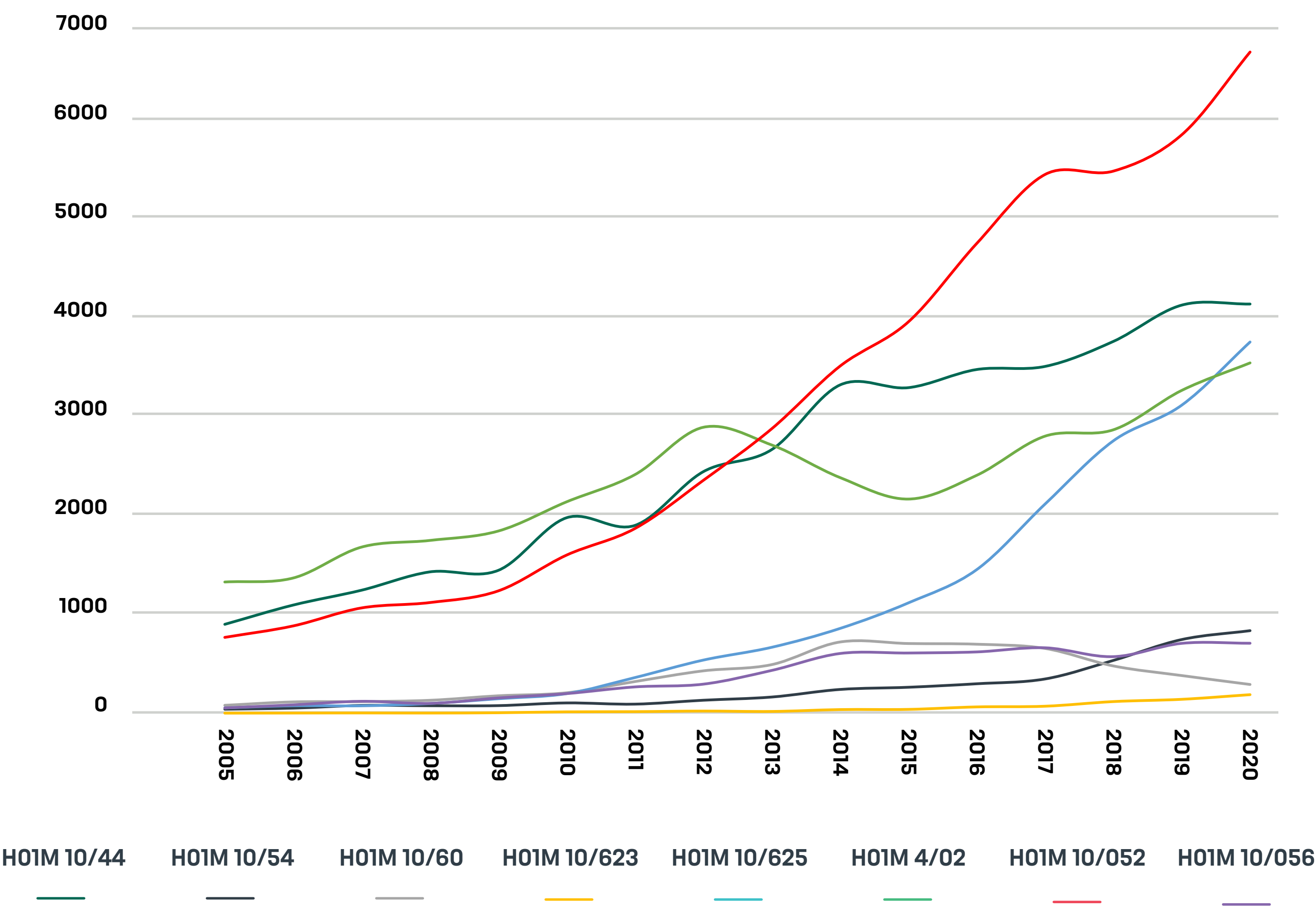


Fig. 2 - Patents granted in different technology classifications between 2005 and 2020.

# WHO ARE THE MAJOR INNOVATORS IN BATTERY TECHNOLOGY?

While Figures 1 and 2 look at what is being filed and granted, Figures 3 and 4 (below) show who is filing what.

We can see LG has a large presence in many of the technical areas. Meanwhile, filings in motive systems are dominated by LG, Toyota and Robert Bosch.

In the field of portable devices, LG, Samsung and Sony are, as one would expect, more dominant.

Innovation in solid electrolyte is fairly evenly split between LG, Samsung, Sony and Toyota.

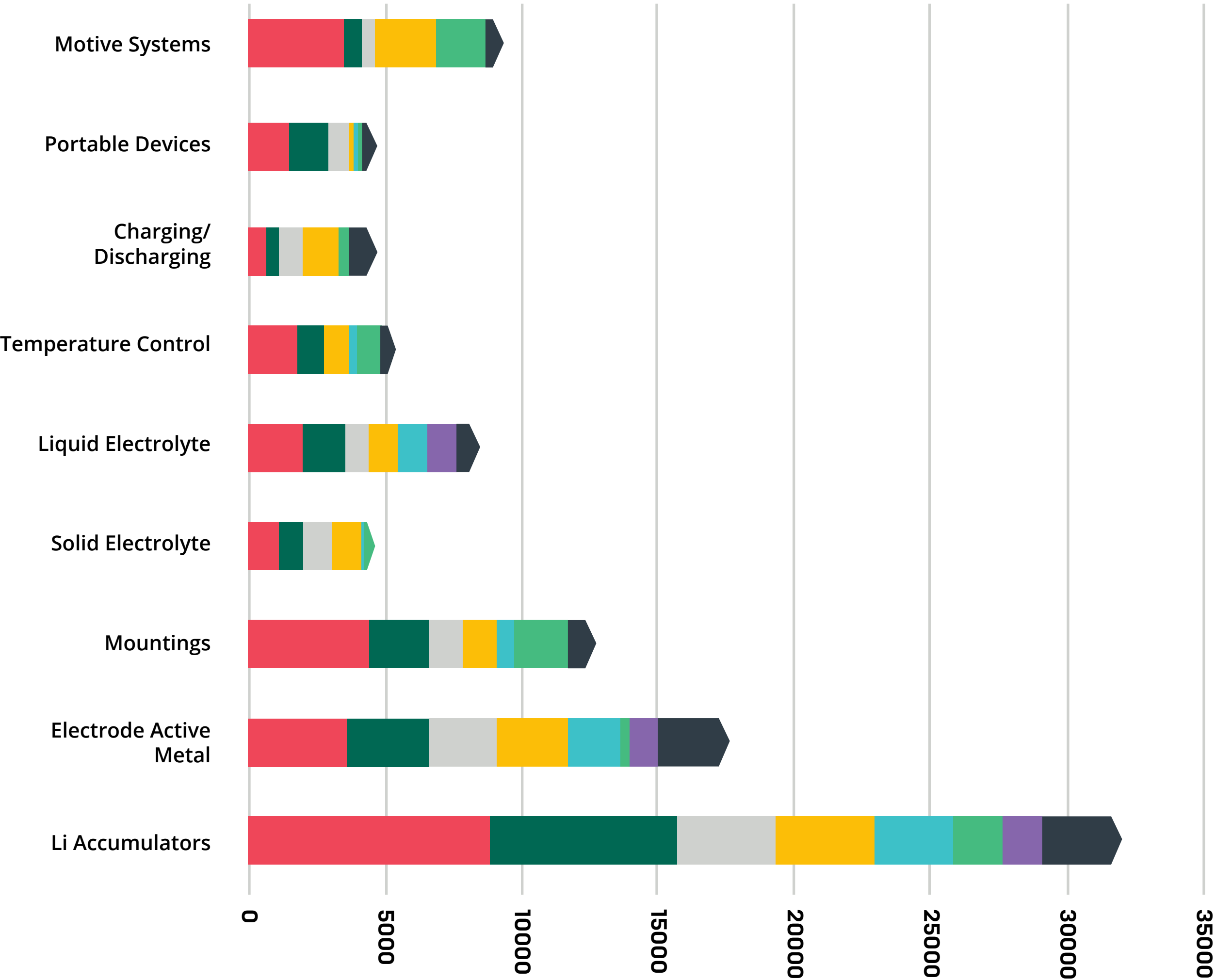


Fig. 3 - Main battery technology filers split into different patent classifications based on worldwide patent applications filed 1999 to date.

# WHO ARE THE MAJOR INNOVATORS IN BATTERY TECHNOLOGY?

Figure 4 shows how each of the main filers splits their research and development efforts.

Panasonic appear to be most invested in lithium technology, electrode active materials and liquid electrolyte. LG not only has a greater number of patent filings, but their spread of technical areas is also greater than many of their competitors.

While this is a snapshot of more than a decade of innovation, it can be interesting to see how the patent filings in each area change over time as it points to the ever-changing R&D focus of a company.

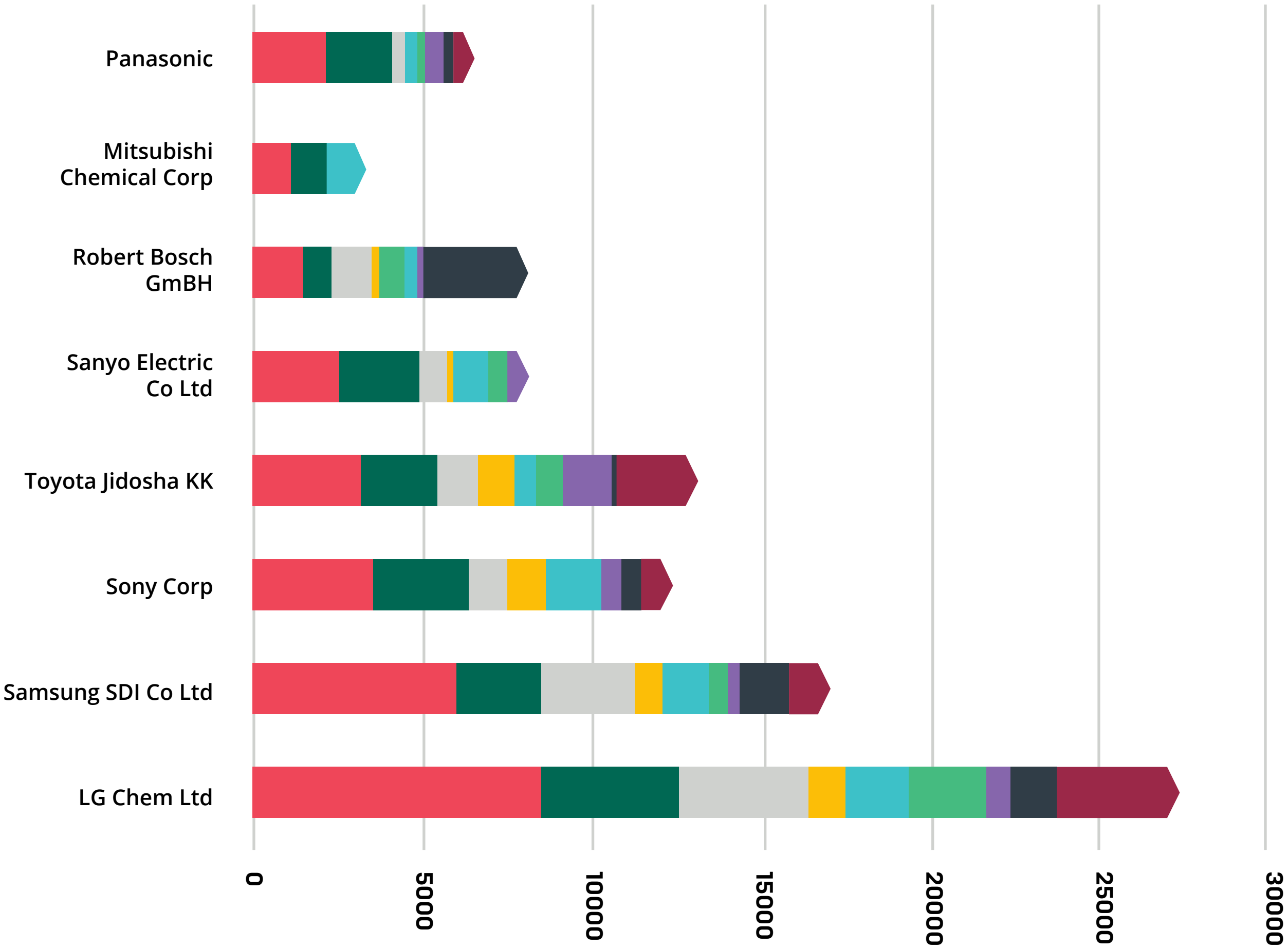
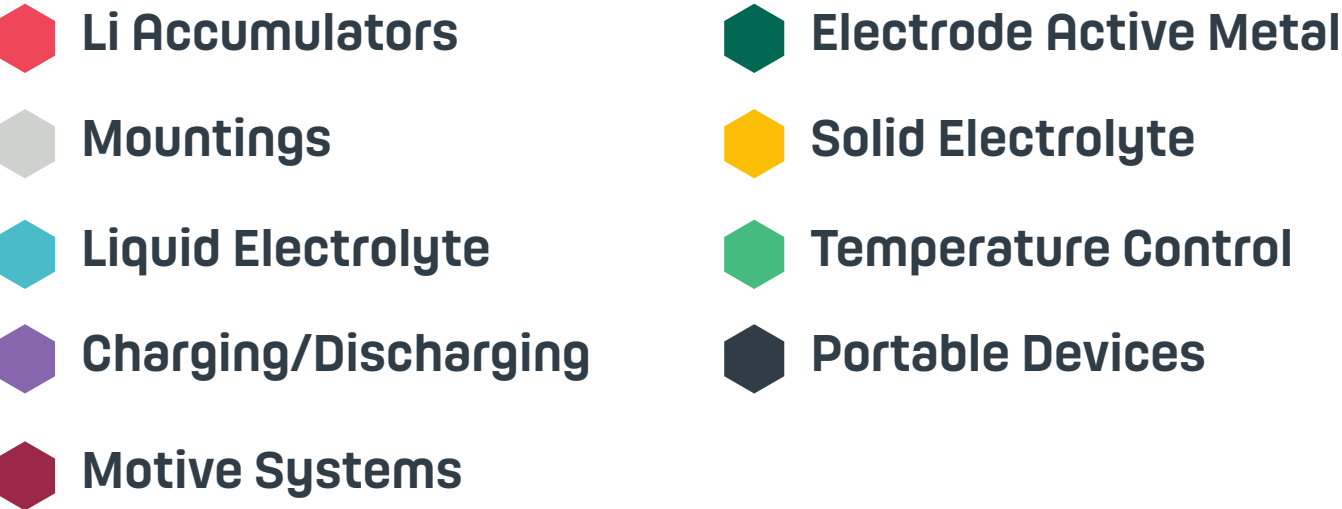


Fig. 4 - Technical areas in which the main battery technology filers make their patent filings.

# WHO ARE THE MAJOR INNOVATORS IN BATTERY TECHNOLOGY?

Figures 5 and 6 look more closely at who is filing in particular areas of battery technology.

We can see from Figure 5 that the largest filer in the battery recycling classification is a university, indicating that this area of technology is in its infancy. The rest of the list is dominated by Chinese and Japanese companies. There is clearly a significant amount of work occurring in China.

However, Chinese companies are often encouraged to file patent applications and including filings made in China can distort some statistics.

Chinese Company

Japanese Company

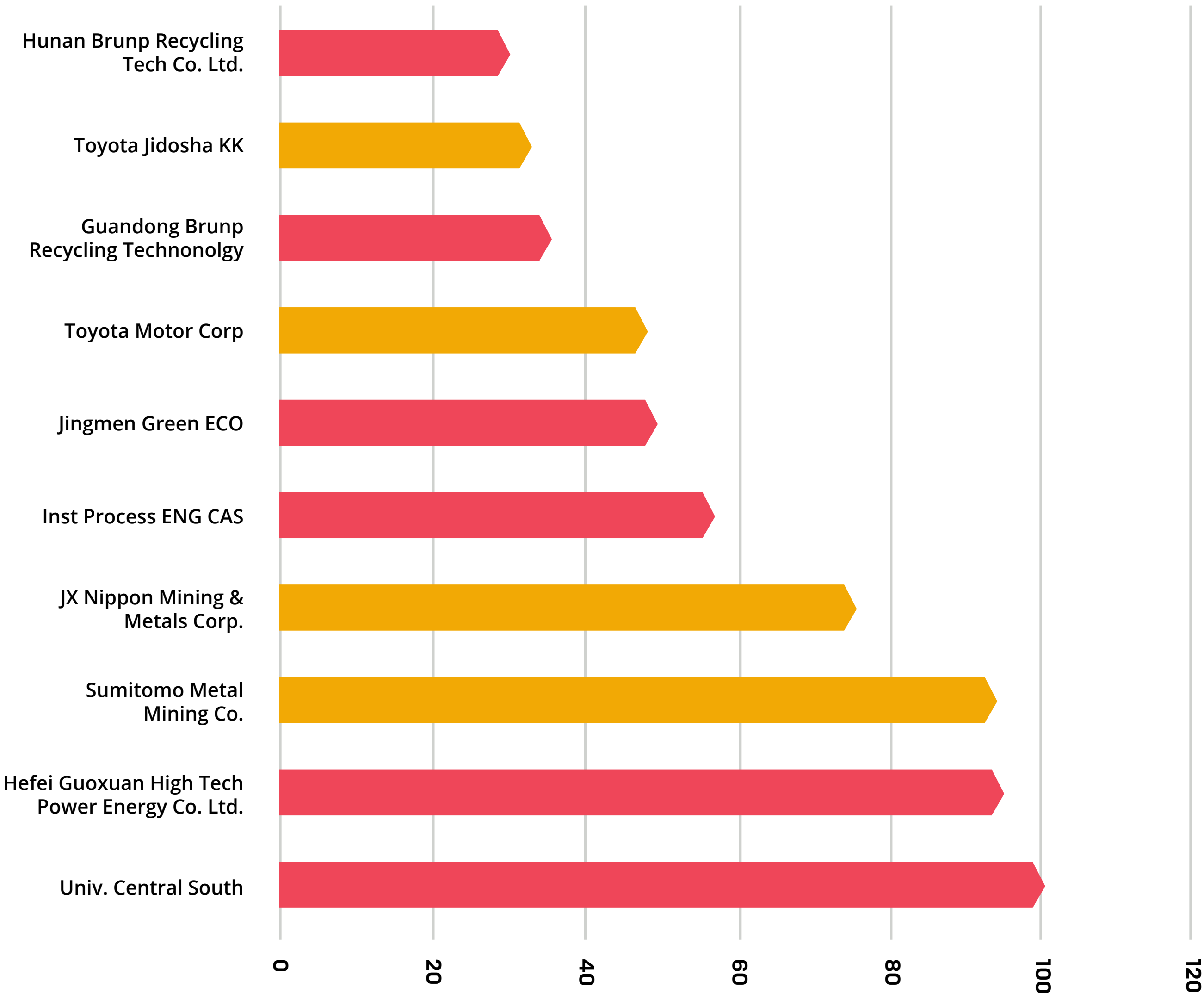


Fig. 5 - Main battery technology filers in the classification for “Reclaiming serviceable parts of waste accumulators”.



# WHO ARE THE MAJOR INNOVATORS IN BATTERY TECHNOLOGY?

Therefore Figure 6 looks at patent filings made outside China (by a company of any nationality). Now we see that the Japanese companies dominate the list and, by implication, have a more global patent strategy.

 Japanese Company

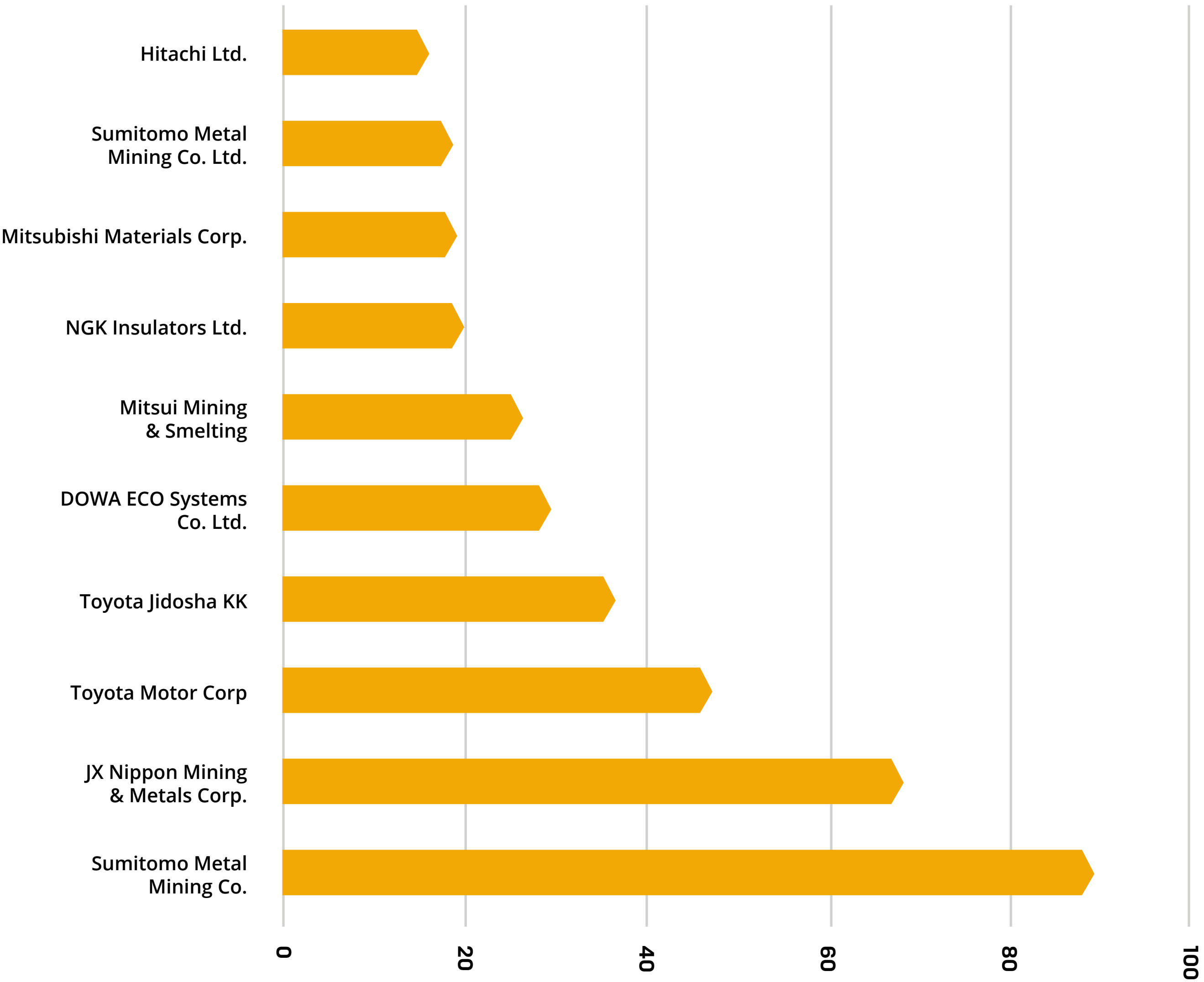


Fig. 6 - Main battery technology filers for “Reclaiming serviceable parts of waste accumulators” from the European Patent Office, the Japanese Patent Office and the US Patent and Trademark Office.

# WHO ARE THE MAJOR INNOVATORS IN BATTERY TECHNOLOGY?

Figure 7 shows the main patent application filers for vehicle cells and, as may be expected, automotive companies feature more heavily than traditional battery innovators such as LG Chem, Samsung SDI and Sony.

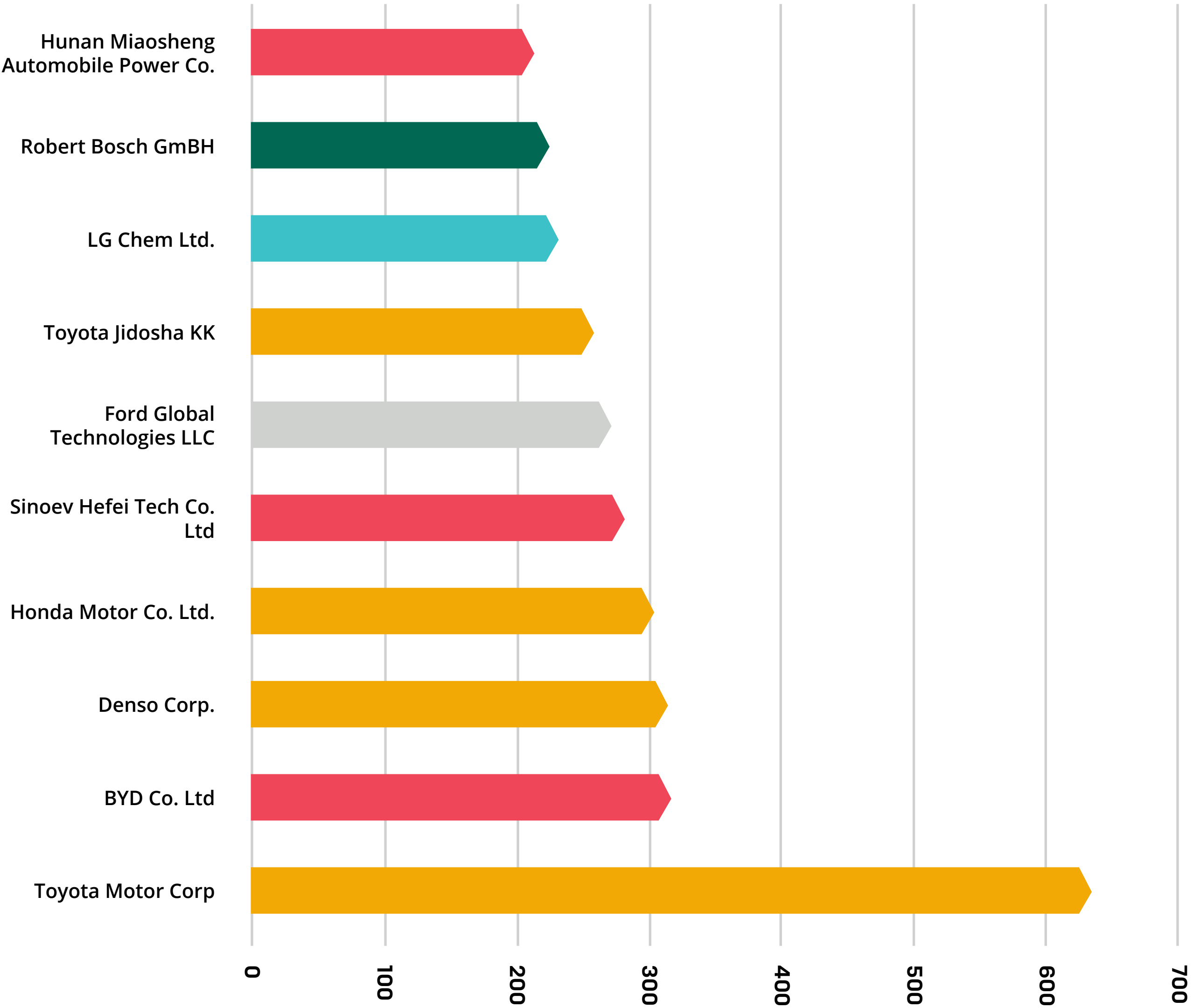


Fig. 7 - Main battery technology filers in the classification for "Cells specifically for vehicles".



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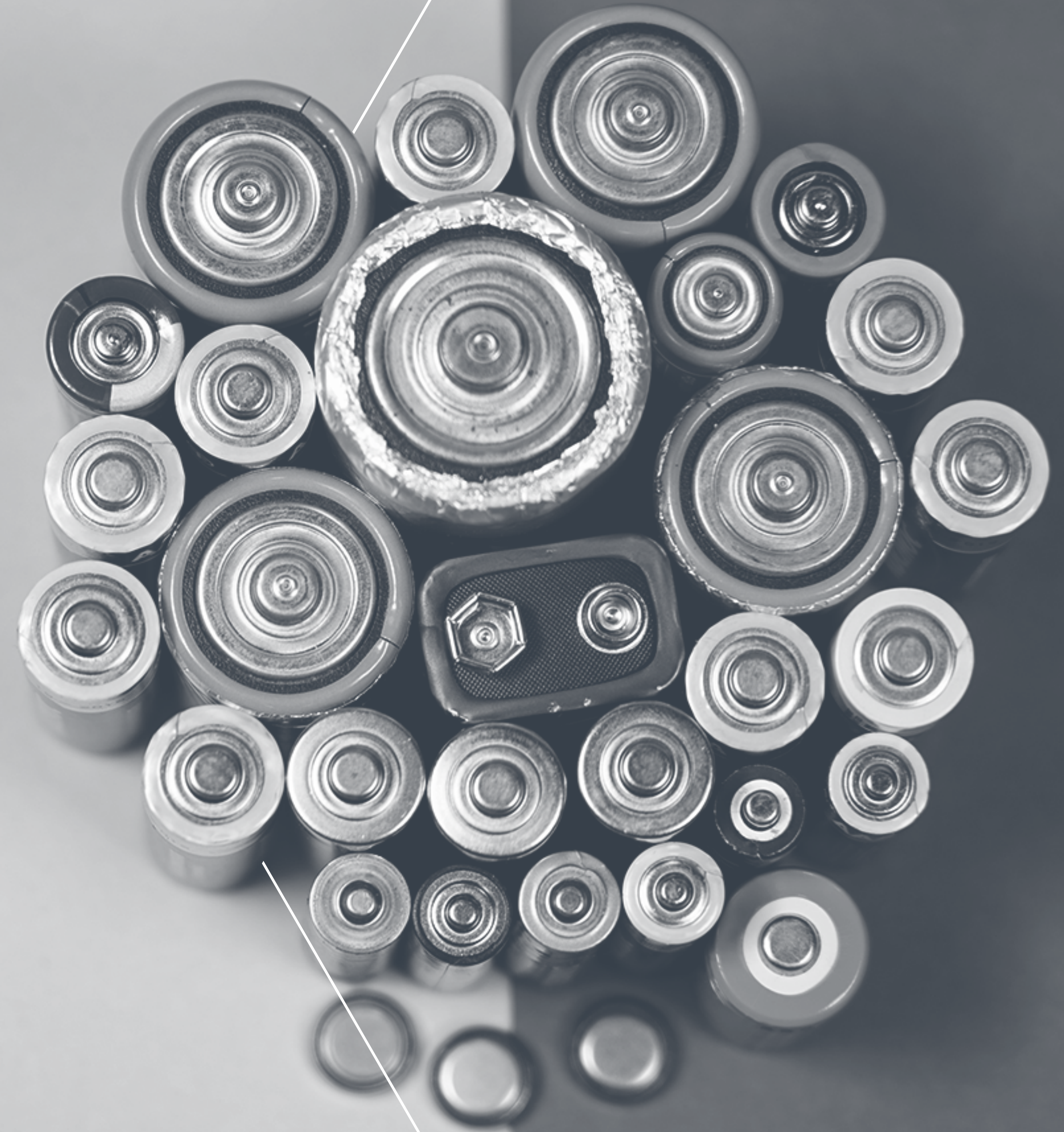
## WHAT DOES THIS ANALYSIS TELL US ABOUT THE FUTURE OF BATTERY TECHNOLOGY?

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**As with any analysis of this type, the main lesson is that understanding the patent landscape in which you operate can massively help any business pursuing growth.**

Not only can it be used to spot problem patents as they are granted, but it will also help you understand where your competitors are innovating and how best to tailor your patent filing strategy.

We trust this will provide all battery technology innovators looking to steal a march on the competition with some commercially valuable food for thought.





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# SPEAK TO OUR EXPERT

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**BEN LINCOLN**

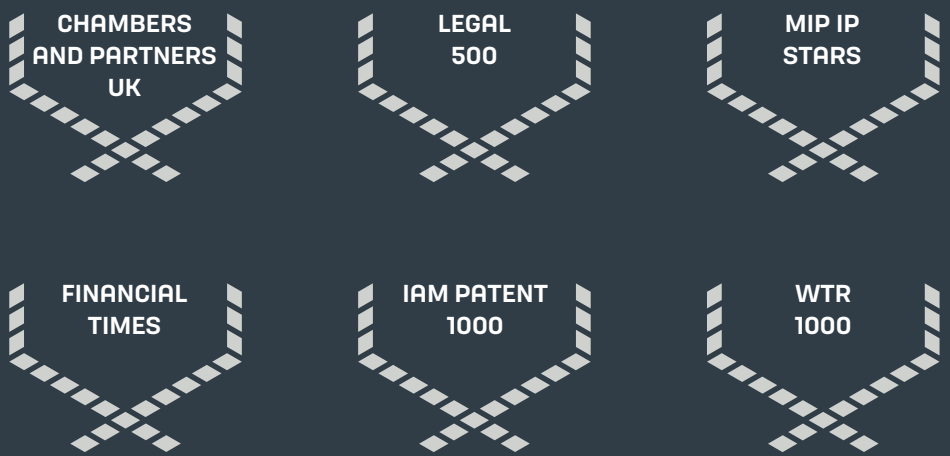
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