

Advancing home-grown batteries innovation

Nissan's plan to build a £1bn Gigafactory in Sunderland has been described as a major boost for electric vehicle (EV) production in the UK and signals that the country's focus on home-grown batteries innovation is starting to bear fruit. However, more investment is needed.

Partly driven by Brexit-related costs and a desire to reduce reliance on raw material imports from overseas, significant investment in innovation has already been made in the UK to enhance existing batteries technology and scale production to meet future EV demand.

With global demand for battery electric vehicles (BEVs) growing rapidly, the current focus is on refining existing lithium-ion battery technology to make it safer and lighter, and improve its energy density so it will last longer. However, a growing number of innovators are also developing alternatives to the dominant lithium-ion technology that could provide a more sustainable solution in the future.

In the push to net zero by 2050, the UK Government's decision to bring forward the proposed ban on the sale of all new petrol and diesel-engine vehicles to 2030, and its promise to invest a further £1bn in batteries innovation and its associated supply chain, has set a challenging pace for Britain's underdeveloped batteries industry. Price reporting agency, Benchmark Mineral Intelligence, has forecast that the UK needs at least 175 GWh of battery cell capacity by 2035 to supply around three million fully-electric vehicles.

To accelerate innovation activity in this area, the Faraday Battery Challenge has received £330m from the Government to sponsor world-class R&D programmes. The aim is to develop cost-effective, high-performance, durable, safe and recyclable batteries and position the UK as an industry leader. Among the innovations generated by the Challenge to date is a new type of sensor that can take samples of material from inside an operational battery, a novel solid-state electrolyte material and a rapid recycling method that is capable of stripping electrode materials up to 100 times faster than other methods.

In a recent announcement by UK Research & Innovation (UKRI), Innovate UK has confirmed that 17 R&D projects will receive £10m from the Faraday Battery Challenge to develop their innovations further and in some cases start production. The announcement demonstrates the vital role that Government is playing in channeling funding to projects capable of delivering a positive commercial outcome in the UK.

Patent filing data for 2016 reveals that the total number of patents published for battery innovations at the UK Intellectual Property Office (UKIPO) was 99. By 2019, the number had risen to 149 – an increase of 50%. This is likely to be an indicator of a much larger increase in filing, and so innovation activity. This is because many UK companies choose to file first at the UKIPO, but then allow their application to lapse without publishing it, in order to pursue an international (PCT) application instead. As such, only around 45% of UKIPO first filings end up being published by the UKIPO and the total number of filings made to the UKIPO in 2020 for batteries innovations is projected to have increased to around 400. While the growth in patents published by the UKIPO for batteries innovations could seem modest, the uptick in filing activity is indication of a fast-growing domestic batteries industry.

Among these patented innovations are technologies designed to extend the life of lithium-ion batteries and enable them to be reused or recycled. For example, the University of Cambridge is developing new electrode materials, with the aim of increasing the power output of lithium-ion batteries in order to extend their life. This is being achieved while ensuring they remain compatible with existing battery management systems. In addition, Siemens and the University of Newcastle are developing new battery analysis methods, capable of providing predictive models for heat degradation. Other innovators, including Dyson, are looking for ways to improve the energy density of lithium-ion batteries through improved cathode chemistry.

Recycling technologies are also generating a high level of commercial interest, with new companies, such as Technology Minerals, and existing companies, such as R S Bruce, already active in this space. Other innovators are paving the way for more recycling

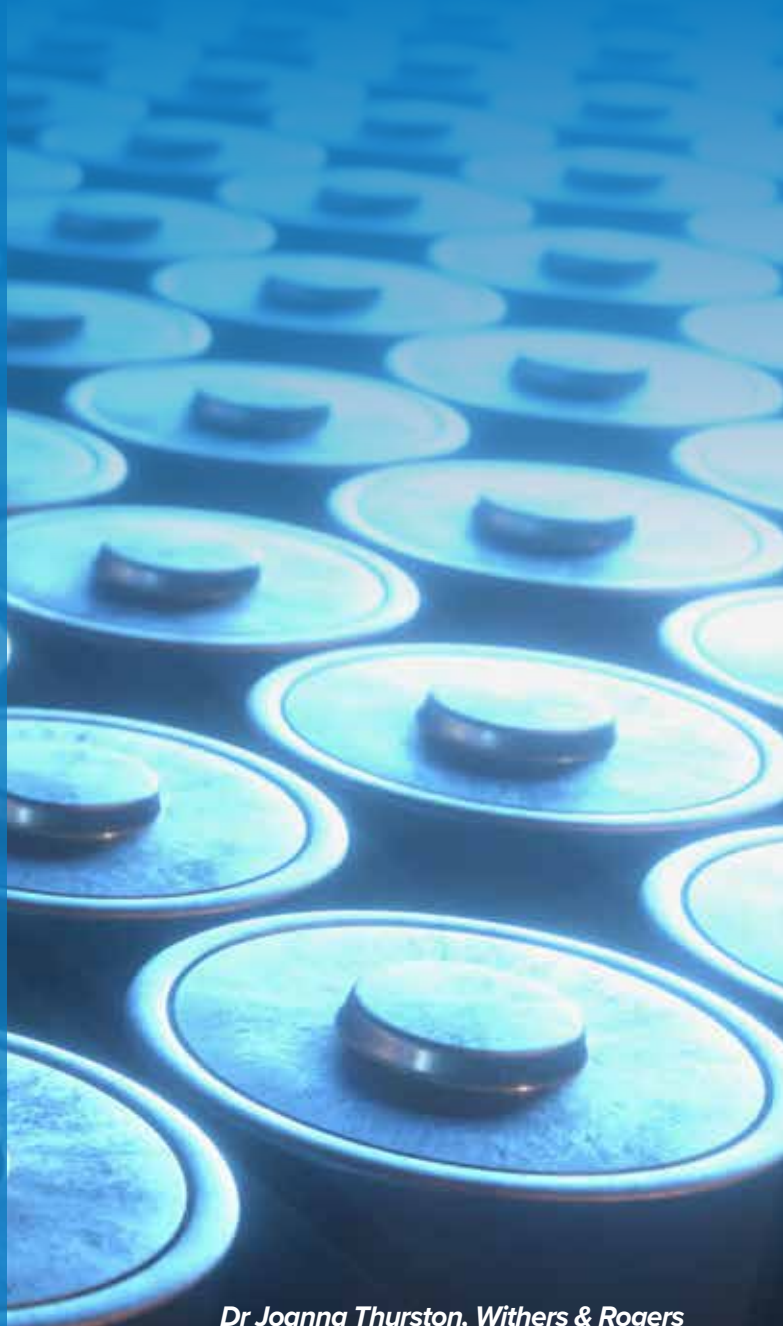
activity – for example, Supac Ltd, based in South Wales, has developed a new container for the safe storage of disused lithium-ion batteries and other technology to facilitate the safe separation of battery components using pyrolysis.

With global demand for BEVs forecast to soar in the next decade and beyond, battery innovators are increasingly focused on finding alternatives for lithium-ion and cobalt, as both metals are finite resources.

Innovation in the area of solid-state batteries that use sodium as a replacement for more expensive lithium is developing strongly. In the UK, a number of innovation-focused companies are exploring ways to develop sodium ion cell capability and improve anode/cathode active material capacity. Lithium-sulphur is another exciting area of battery innovation. While much innovation in this area is focused on the US, some UK-based R&D programmes are also exploring the potential of lithium-sulphur technologies, which use a lithium metal anode and a sulphur-based cathode, to develop batteries that are lightweight, safe and potentially also rechargeable. Another small group of innovators are focused on the development of lithium-air batteries, due to their incredibly high theoretical energy densities.

The next few years are certainly going to be an exciting time for batteries innovation in the UK and around the world. There are many rich seams of research activity that are likely to generate patentable innovations in the next few years, and for those that get there first, there could be significant commercial reward. For spin-out and early-stage companies, securing patent protection can help to secure the funding needed to develop innovations and bring them to market as quickly as possible. Larger, more established companies, also need to keep a close eye on competitor activity and protect their innovations promptly to avoid them being copied or reverse engineered.

The UK's race to net zero is underway and today's investment in home-grown batteries innovation will play a critical role in determining where the country ranks as a global producer of BEVs in the future.



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