Brace Yourself for the Next Generation of Smartphone Batteries

We all use batteries in some form or the other. Batteries have become an integral part of our daily lives. Be it inverter batteries, solar batteries, cars batteries, or dry batteries we use in smartphones. Use of batteries is inevitable now. However, with all the advantages we enjoy, we are also well versed with the limitations of the batteries we use daily. The batteries, at present, have limited charging capabilities in proportion to their size. This size issue might not be very daunting in case of inverter or car batteries; however, the size issue is vexatious when it comes to smartphone, tablets, and laptop batteries.

Nowadays, if you need a smartphone with a high-capacity battery, you must compromise with the size of your smartphone. Battery size must be increased in order to increase its charging capacity; it is ineluctable. Also, with greater battery size comes greater battery weight. Overall, you cannot choose a lightweight battery with better performance or a better performing battery with lesser size, or vice versa. We all have learnt to live with this limitation, as chemistry is to be blamed here for the issue.

For example, lithium-ion batteries which we commonly use in our smartphones have limited capacity to absorb and retain charge. To increase the charge, we need to increase the size of the electrodes as it is the only available solution. However, increase in the electrode size obviously results in increase in battery size and battery weight. To overcome this, one of the viable solutions is to switch to some better materials than lithium-ions that can provide higher charge retention with the same battery size.

Moreover, the material we need must have better charging capabilities than the lithium-ions and has to be economically available. As per all the research done till date, Lithium-sulphur combination seems to provide just that. The first reason in favor is that Lithium-sulphur has at least 60% more charging capability than the existing Lithium-ion batteries. This results in having nearly double battery charge (in ideal conditions) with the same battery size we currently use in our smartphones. The second reason in favor is the cost of using sulphur as sulphur is easily available for industrial use and is nearly dirt cheap.

Then why are we not using Lithium-sulphur batteries already?

Chemistry is again to blame here, as sulphur is known to have a tendency of dissolving very rapidly. In batteries, sulphur is required to hold battery components and to keep the electrical circuit from breaking. Thereby, when sulphur dissolves, the battery dies. This makes commercial use of Lithium-sulphur batteries inappropriate at least in smartphones as the smartphones require batteries that can be charged again and again up to many cycles.

However, scientists never lost hopes on the Lithium-sulphur combo and tried their best to find a solution to prevent sulphur from dissolving, or at least to ensure that sulphur dissolves very slowly to keep the electric circuits working for many charge cycles.

Basically, scientists started looking for an inert material that can be used as a binder to hold the sulphur structure together and prevent it from dissolving. However, they were not able to get desired results with this approach. Even the minor success they were getting was not without pushing up the cost of

manufacturing. On the contrary, scientists were aiming to find a solution that can keep the cost of Lithium-sulphur batteries competitive as to the Lithium-ion batteries.

Luckily, scientists invented a synthetic polymer binder that instead of being inert in nature, reacts with the sulphur and forms covalent bonds. Due to the stronghold of the covalent bonds, the synthetic polymer prevented the sulphur from dissolving in the battery casing. However, the synthetic polymer again was not very economical to produce. Scientists had to look for alternatives. But this time, instead of looking for a totally new synthetic alternative, scientists started looking for naturally occurring materials that can replace the invented synthetic polymer.

Solution: Red seaweed

The red seaweed is basically a form of algae which contains a substance known as 'carrageenan'. Carrageenan had the same group of atoms and same reactivity as the synthetic polymer that helped in preventing sulphur from dissolving. In experiments, carrageenan worked well and efficiently solved the sulphur dissolving issue. Further, as carrageenan is extracted from the red seaweed, which is naturally occurring algae, it is believed to be an economical and viable solution.

Ultimately, we can now expect Lithium-sulphur batteries to become a norm soon in future. This will help in getting almost double battery capacities without any increase in battery size, battery weight, and even battery cost. However, availability of the Lithium-sulphur batteries in the market is not expected anytime soon as the scientists are still researching this technology and trying to further improve the cost and performance of the Lithium-sulphur batteries. Also, not to forget, Lithium-sulphur technology is relatively new in comparison to the well-known Lithium-ion technology.

Currently, there are around 4000 patents filed worldwide on Lithium-sulphur technology, whereas there are millions of patents filed already on Lithium-ion technology. This itself proves that Lithium-sulphur technology has a long way to go to match with the worldwide acceptability of the Lithium-ion batteries. At present, Robert Bosch, Samsung, LG, etc. are the leaders in filing patents on Lithium-sulphur technology. This strongly suggests that we can expect Samsung and LG to be the first ones to provide us with smartphones equipped with the Lithium-sulphur batteries. So, Brace yourself!

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