Flow battery technology new delhi

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Where space is not a constraint, flow batteries are deemed to be good energy storing devices. In conventional batteries, energy is stored in solid electrodes. In flow batteries, the storage of energy is in liquid redox electrolytes, which can be kept in tanks outside the cells -- if you want to store more energy, you just make the tanks bigger. They can indeed be as big as you want, there is no limit. If you want more power, you only have to increase the number of cells or stack size.

Flow batteries have been around for some time, but industry is increasingly looking to them for applications such as storing electricity to handle the intermittency issue in solar and wind farms or maintaining grid stability.

In countries like Australia, where people live in far-flung areas, flow batteries are fast replacing conventional diesel gensets.

Researchers the world over are trying to improve the performance of flow batteries. In this, a team of scientists led by Prof Kothandaraman Ramanujam and Prof Sankararaman S, Department of Chemistry, Indian Institute of Technology, Madras, have developed a "non-aqueous all-organic redox flow battery" (NORFB), which promises improved performance.

Conventional flow batteries feature aqueous (water-based) electrolytes like hydrochloric acid, sulphuric acid, and alkali metal hydroxides, which bring forth two problems. One, the water interferes by undergoing electrolysis and, therefore, reducing the operating voltage limit and energy density (amount of energy packed per unit volume or gram); and two, they corrode battery components.

Thus, as an alternative, researchers have been looking for electrolytes that are non-aqueous and organic.

The IIT-M researchers have developed a new type of electrolyte using "pyrylium salts", which are a class of organic chemicals.

Technically, with suitable structural modifications these chemicals allow high-voltage operation, namely they can store more energy. Ramanujam told Quantum that the team achieved current densities of 40 mA/sq cm, which is pretty high (as the redox materials were charged and acting as conducting medium). The team used "2-, 4-, 6-triphenylpyrylium tetrafluoroborate" as the anolyte, and "N-decylphenothiazine" as the catholyte. Ramanujam said these chemicals can be produced easily and are cheap.

The electrolyte is designed to carry more current density as well as voltage. The battery has been demonstrated with an average coulombic efficiency of 97 per cent.

While the anolyte material offers high solubility and reversibility, it is not as stable as desired. However, re-engineering the molecule can impart the desired stability.

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