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Lithium-Air Batteries: Technology Trends and Commercialization Prospects

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Abstracts

Electric vehicles are facing numerous technological challenges to replace gasoline internal combustion engine-powered cars. One of the biggest problems is low energy density of currently available li-ion batteries, which allows a short driving range of 150 km/charge. To boost full-scale development of the EV market, replacing current internal combustion engine cars, it is necessary to develop EVs with a similar single charge range of more than 500km with internal combustion engine cars.

According to NEDO (Japan), the energy density limit of li-ion secondary batteries is expected to be up to 250 Wh/kg. To develop EVs with the 500km range, which is considered as a prerequisite for growth of the EV market, it is required to develop a new type of battery that has energy density of 700 Wh/kg or more. Among several candidate technologies, metal-air batteries such as lithium-air and zinc-air batteries are considered as the most promising.

The biggest advantage of metal-air batteries is very high theoretical energy density in spite of using oxygen as Natures inexhaustible source as well as eco-friendly characteristics. Comparing various metal-air batteries based on electric charge/discharge and other electro-chemical characteristics, lithium-air and zinc-air batteries are recognized as the most likely candidates for next-generation secondary batteries for EV applications. Especially, lithium-air batteries show a similar level of energy density (11,140 Wh/kg) with gasoline (13,000 Wh/kg), and this is also the highest level among metal-air batteries. These potentialities have directed many researchers to focus on lithium-air batteries rather than zinc-air batteries since the mid-2000s.

Although it is forecasted that lithium-air batteries are far away from commercialization

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due to many issues to be overcome, it is a very challenging field requiring knowledge and expertise of researchers in a variety of areas. Currently many global leaders such as IBM, Toyota, and Samsung are continuously entering the R&D race with increasing investment, and these aggressive R&D activities based on technological achievements in the fields of li-ion and fuel batteries are expected to contribute to solving the technological challenge earlier, and accelerating commercialization.

This report examines the most noteworthy post-LiB technology, namely lithium-air batteries, in terms of technological issues, elemental technologies, technology development trends, and patent trends.

The strong point of this report is the up-to-date technology development trend in the field of lithium-air batteries including:

Analysis of development projects and roadmaps for next-generation secondary battery technologies in each country

technological issues and elemental technologies of lithium-air batteries

Patent trends of metal-air and lithium-air batteries

Analysis of development status of various lithium-air battery companies and research institutes in different countries

Prospect of future applications and commercialization of lithium-air batteries.

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