All Solid State Tungsten-air Battery: A New Metal-air Chemistry

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Metal air batteries have garnered intense interests in recent years due to the extremely high energy density contributed by the readily-available cathode-air. However, a key barrier limiting the commercialization of the conventional metal-air batteries (e.g. lithium-air and zin-air) for mid- and large- scale energy storage is the poor reversibility and low rate capacity caused by air-pathway congestion, evaporation/decomposition of liquid solvent electrolytes, or carbonate precipitation[1-6].

Recently, our group demonstrated a novel concept of "all solid-state iron-air battery" that innovatively combines a reversible solid oxide fuel cell (RSOFC) and a hydrogen chemical-looping energy storage unit (ESU) [7-9]. This battery circumvents the air pathway clogging issue by taking advantage of the redox reactions of gaseous O_2. In addition, the all solid components make the aforementioned problems for the conventional liquid-based metal-air batteries no longer an issue.

Benefited from the decoupling design of this battery, new metal-air chemistries can be explored and introduced simply by substituting the materials in ESU. As shown in Fig. 1, an all solid-state tungsten-air battery is recently demonstrated in our lab [10].

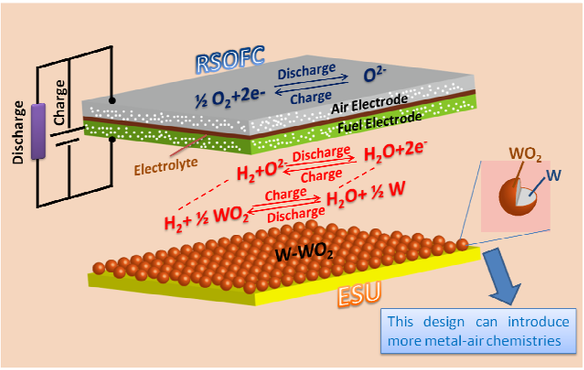

Fig.1 A schematic illustration of the working principle of the new rechargeable all solid-state tungsten-air battery

Due to the higher specific density and better redox kinetics of tungsten, the new tungsten-air battery exhibits higher energy density (Wh/L) than the previously reported iron-air battery.

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