High-Energy-Density Rechargeable Battery Technologies based on Anionic Redox

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Abstract: By the employment of lithium transition metal (TM) oxide cathodes, the gravimetric specific capacity of Li-ion batteries are seriously limited by the cationic redox reactions of heavy TM cations. As for Li-O_2 battery, it takes the advantage of the light oxygen-related anionic redox chemistries, which can contribute remarkably higher theoretical gravimetric energy density. However, the practical realization of Li-O_2 battery, a gas-open cell architecture, is severely plagued by some gaseous O_2-related intrinsic defects. A novel synergistical modification ideal is abandoning the utilization of gaseous O_2, and controlling the high-energy-density oxygen-based redox reaction processes within the redox interconversion among different solid phases (a more commercialized sealed cell environment).[1] Herein, we introduce a promising high-energy-density Li_2O/Li_2O_2 anionic redox reaction into rechargeable battery devices, a sealed oxygen-related anionic redox dominated battery system. Coupled with Li-metal anode, we obtain a 500 Wh/kg pouch-type cell with around 80% energy density retention rate after 100 cycles.[2] We want to pass a straightforward message to battery researchers, arousing their attentions onto the development of this promising high-energy-density anionic redox based battery system, which owns tremendous potential to boost the energy density of rechargeable battery for EVs.

References:

[1] Qiao, Y.; Jiang, K.; Deng, H.; Zhou, H. *Nature Catalysis* **2019**, *2*, 1035-1044.

[2] Qiao, Y.; Deng, H.; He, P.; Zhou, H. *Joule* **2020**, *4*, 1445-1458.

Biography:

Yu Qiao is a currently a professor in the College of Chemistry and Chemical Engineering at Xiamen University. He earned his B.S. degree from the University of Science and Technology of China (USTC) in 2013. He received his Ph.D. degree from Tsukuba University (Japan) in 2019, and the worked as a postdoctoral fellow at the National Institute of Advanced Industrial Science and Technology (AIST, Japan). His research interests are focused on the development of electrochemical energy storage devices, surface/interfacial electrochemistry, and operando spectroscopic characterizations.