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## POS-14 Metallic Li and Na Anodes for Next Generation Li and Na Metal Batteries

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Metallic Li is considered as the promising anodes for next generation Li-metal batteries including Li-S, Li-air and all solid-state batteries. However, it is still a crucial problem of Li dendrite growth and large volume change during the stripping/plating process. In our study, the advanced atomic/molecular layer deposition (ALD/MLD) is used to deposit protective coatings on Li metal with excellent coverage and controllable thickness to stabilize the SEI layer and longer the life time [1].

Herein, we demonstrated MLD alucone (Al-EG and Al-GLY) as protective layers for Li metal anode with improved stability and life time, leading to the better performances than ALD Al<sub>2</sub>O<sub>3</sub> [2]. Furthermore, the conductive carbon paper (CP) is proposed as an “interlayer” for Li metal anode with super long-life time under high current density [3].

Na metal anode also shows the great potential for the Na metal batteries [4], which facing the similar problems of dendritic Na growth. Here, we demonstrated the successful application of both ALD Al<sub>2</sub>O<sub>3</sub> and MLD alucone protective coatings on Na metal anode in ether and carbonate-based electrolyte, respectively, to achieve long lifetime Na metal anode with suppressed dendrite growth [5]. To further reduce the dendrite growth and minimize the volume change, the 3D skeleton (carbon paper with N doped carbon nanotube) has been design with excellent electrochemical performance under high current density and high capacity [6]. To address the practical problems in Na-O<sub>2</sub> batteries, the CP is used as “interlayer” to avoid the corrosion of Na metal and reduce the dendritic Na growth [7].

In conclusion, we developed the different approaches, including ALD and MLD protective layers, interlayers, and 3D skeleton design, for Li and Na metal anodes with enhanced electrochemical performances and reduced dendrite growth. Meanwhile, the ideas have been also applied to solve the practical issues for testing Li and Na metal batteries.

[1] X. Meng, X. Sun, *Advanced Materials*, 2012, 24, 1017; Y. Zhao, X. Sun, *ACS Energy Letters*, 2018, in press (review paper)

[2] Y. Zhao, X. Sun, *Small Methods*, 2018, DOI: 10.1002/smll.201703717; A. Lushington, X. Sun, submitted

[3] Y. Zhao, X. Sun, *Nano Energy*, 2018, 43, 368

[4] H. Yadegari, X. Sun, *Advanced Materials*, 2016, 28, 7065

[5] Y. Zhao, X. Sun, *Advanced Materials*, 2017, 29, 1606663; Y. Zhao, X. Sun, *Nano Letters*, 2017, 17, 5653

[6] Y. Zhao, X. Sun, *Small*, 2018, DOI: 10.1002/smll.201703717

[7] X. Lin, X. Sun, submitted

**Author:** ZHAO, Yang (Department of Mechanical and Materials Engineering, University of Western Ontario)

**Co-authors:** LIN, Xiaoting (Department of Mechanical and Materials Engineering, University of Western Ontario); Dr YADEGARI, Hossein (Department of Mechanical and Materials Engineering, University of Western Ontario); LUSHINGTON, Andrew (Department of Mechanical and Materials Engineering); Dr SUN, Qian (Department of Mechanical and Materials Engineering); LI, Ruying (Department of Mechanical and Materials Engineering); Prof. SUN, Xueliang (Department of Mechanical and Materials Engineering)

**Presenter:** ZHAO, Yang (Department of Mechanical and Materials Engineering, University of Western Ontario)

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