Fabrication of the random mixed Li-Cu structure to prevent dendrite growth for lithium metal battery.

Sun Woo Hwang[1], Jee Ho Yeom, Jae Won Lee, Sumg Man Cho and Woo Young Yoon*

Department of Materials Science and Engineering, Korea University, 1, 5Ga, Anam-dong, Sungbuk-Gu, Seoul 136-701, Republic of Korea., email adress: luffi778@gmail.com
**Corresponding author: E-mail address: wyyoon@korea.ac.kr; Tel.: +82 2 3290 3274; Fax: +82 2 928 3584*

The lithium (Li) metal is the most appropriate material for rechargeable Li metal battery (LMB) system by anode. It has enormous theoretical capacity at 3860 mAh g^{-1}, low pure density at 0.534 g cm^{-3} and lowest negative standard hydrogen electrode (SHE) at -3.045 V [1]. In this reasons Li metal anode is promised to applicate the post Li ion battery (LIB) industry such as electric vehicle (EV) and energy storage system (ESS). However usage of Li metal is restricted by dendrite growth of Li metal when Li ions are deposited on the Li surface. It makes loss of electrolyte and reducing safety of battery. To solve this problem we recommend the random structure which mixed the Li and Copper (Cu) powder.
We made the Li metal as the powder by droplet emulsion technique (DET), the average diameter of Li powder as 10 μm. The Li powder and Cu powder (< 20 μm) were mixed by the wye tube (Li: Cu = 2: 1 vol. %) and rotated 1,000 rpm at 24 hours. Afther mixing process we put the polyvinylidene fluoride (PVdF) binder and triethly phosphate (TEP) to fabricate the slurry. We casting the slurry on the Cu foil and heated the oven 12 hours.
The Li-Cu structure can block the dendrite growh when Li ion deposited on the Li metla surface. The Cu powder mixed with the Li powder which controlled the movement of Li ion. It makes Li ions stacked there origin sites when the battery charged. Also it makes available to increase the Li usage. The Cu structure can maintain there morpholgy in spite of battery cycling. Then Li can possibly stacked the vacancy site which located beside the Cu structure in stable. This characterstics make increase the energy density, life and safety of Li metal anode and suitable to applicate the post LIB system such as Li-S and Li-O_2 battery

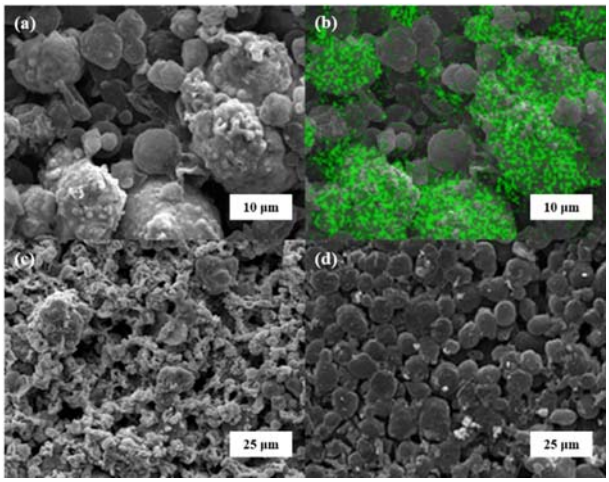

Figure 1. The SEM and EPMA images of Li-Cu structure. (a-b) SEM images of pure Li-Cu (green : Cu), (c) 100 cycles discharged (d) 100 cycles charged Li-Cu surface

Reference

[1 W. Xu, J. Wang, F. Ding, X. Chen, E. Nasybulin, Y. Zhang and J-G. Zhang, Energy Environ. Sci. 7 (2014) 513-537.