Influences of annealing temperature on modified active carbon electrochemical behaviors and mechanism study
Haitao Xue*, Liangxing Jiang, Bo Hong, Xiaoying Yu, Jie Li, Yexiang Liu
School of Metallurgy and Environment, Central South University
Changsha 410083, P. R. China

Lead carbon battery, due to the carbon added to the negative electrode, overcomes the disadvantage of lead electrode sulfation and improves the high rate partial state of charge performance.\(^1\)\(^-\)\(^5\) The combination of super capacitor and lead-acid battery shows higher power, higher capacitance and longer life than traditional lead-acid battery. However the operational potentials of carbon and lead are different. Towards the end of charge, carbon produces significant hydrogen gas, decreasing charging efficiency and causing damages to battery. Hence, carbon modification is necessary\(^1\).

In this work, active carbon (AC) is dipped in Pb(NO\(_3\))\(_2\) solution and proper amount of precipitant is added under agitation. Annealing at different temperatures under Ar gas atmosphere follows filtration and dry. Then the ACs are characterized by SEM, XRD, BET and electrochemical behaviors are tested.

XRD results show that different annealing temperature makes different product and AC morphology varies in SEM. BET results show that each modified AC has a smaller specific surface area than the unprocessed AC, pore volume decreases and the mean pore diameter shrinks due to the pore blockage, annealing process. Namely, AC surface and its pore structure is reshaped. Electrochemical tests reveal that hydrogen gas evolution current on AC is greatly improved causing by less active spots for gassing\(^6\) and the existence of Pb\(^{2+}\). However, some modified AC specific capacitance may be lower than the unmodified AC due to the blockage of pore and coverage of surface. In addition, the AC specific capacitance decreases when hydrogen gas evolution current decreases. The reason maybe that H\(^+\) involves in the both electrochemical processes at the same time and the AC morphology change has some effects on H\(^+\) diffusion leading to hydrogen gas evolution and faradaic pseudocapacitance change towards the same way.\(^7\)\(^-\)\(^8\)

References

Acknowledgement
This research was funded by the National Natural Science Foundation of China (No.51204208).

*1050525728@qq.com