

第三届新型电池电解质/隔膜材料技术国际论坛

高比能量电池 电解液开发进展

周邵云

广州天赐高新材料股份有限公司

Guangzhou Tinci Materials Technology Co., Ltd.

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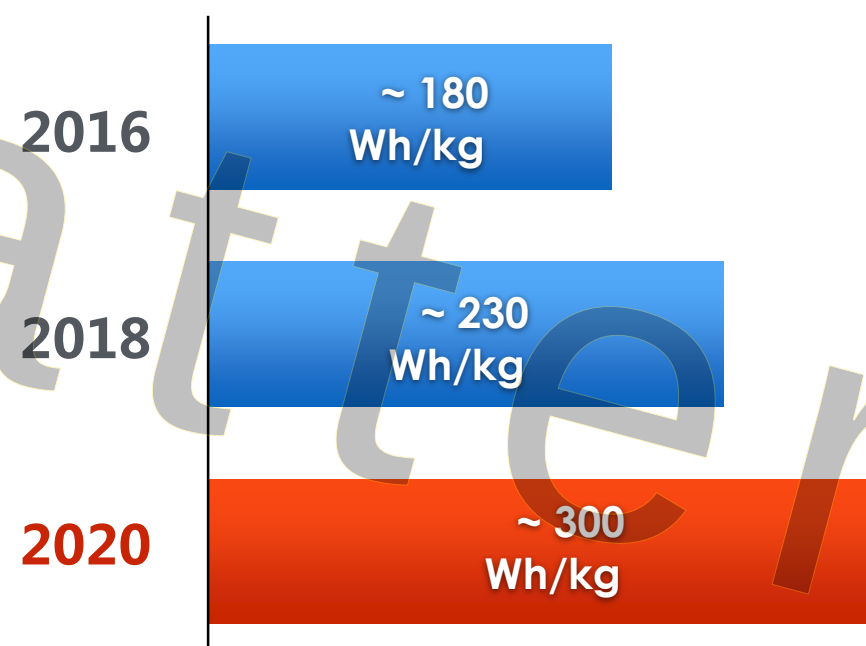
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《动力电池与电池管理系统: 高安全高比能锂离子电池技术》

Requirements

电池单体能量密度	$\geq 300\text{Wh/kg}$
循环寿命	$\geq 1500\text{次}$
成本	$\leq 0.8\text{元 /Wh}$
年生产能力	$\geq 1\text{亿瓦时}$
安全性达到国标要求	

Roadmap



Solutions



Hi-Ni NCM



Si/C

Roadmap

2016

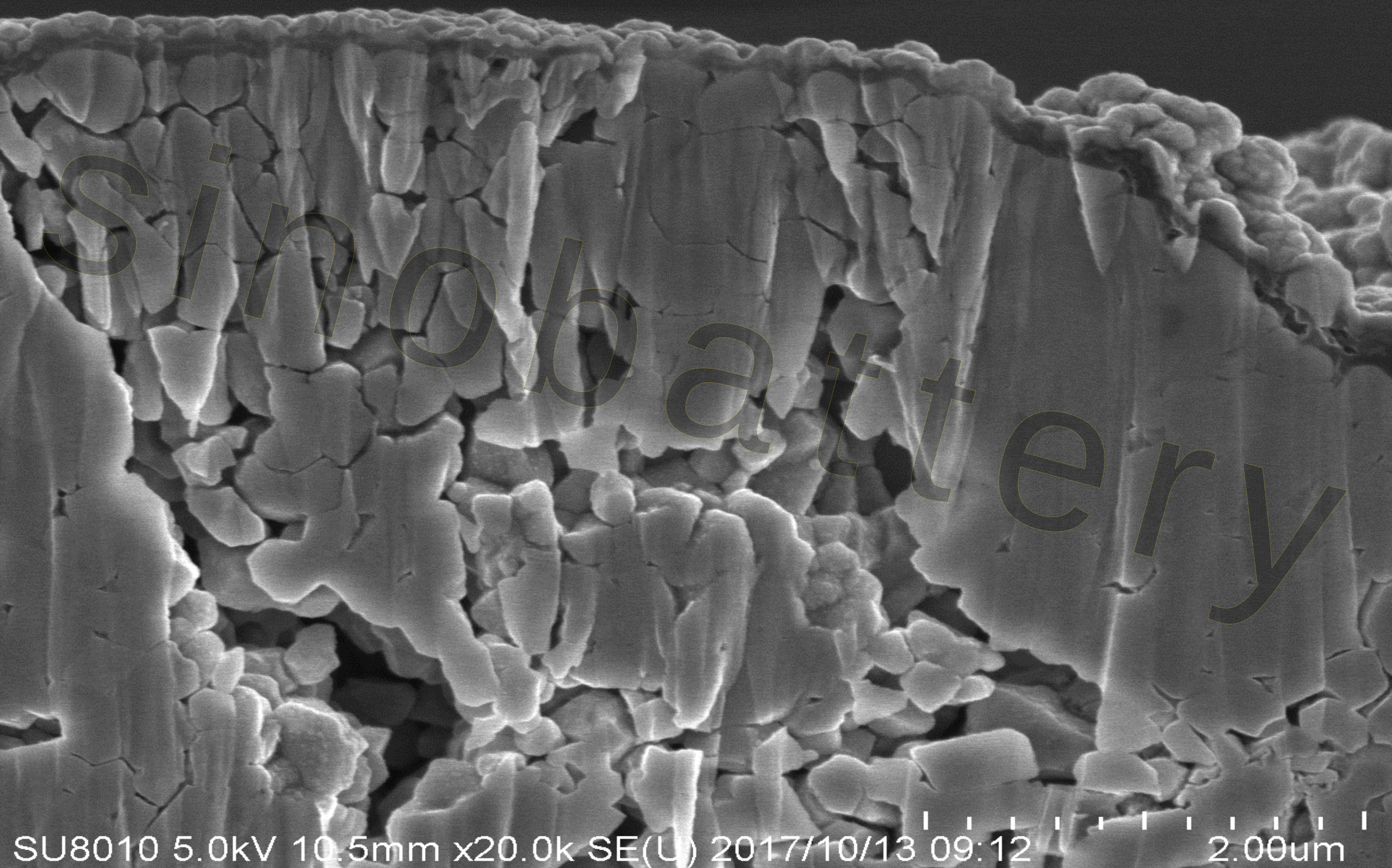
~ 180 Wh/kg

2018

~ 230 Wh/kg

2020

~ 300 Wh/kg



Ni^{4+} 持续氧化电解液使得高镍材料二次颗粒内部产气出现裂缝

1

Hi-Ni NCM or NCA coated by Al_2O_3

2

CEI formed by electrolyte additive

1

Hi-Ni NCM or NCA coated by Al_2O_3

2

CEI formed by electrolyte additive

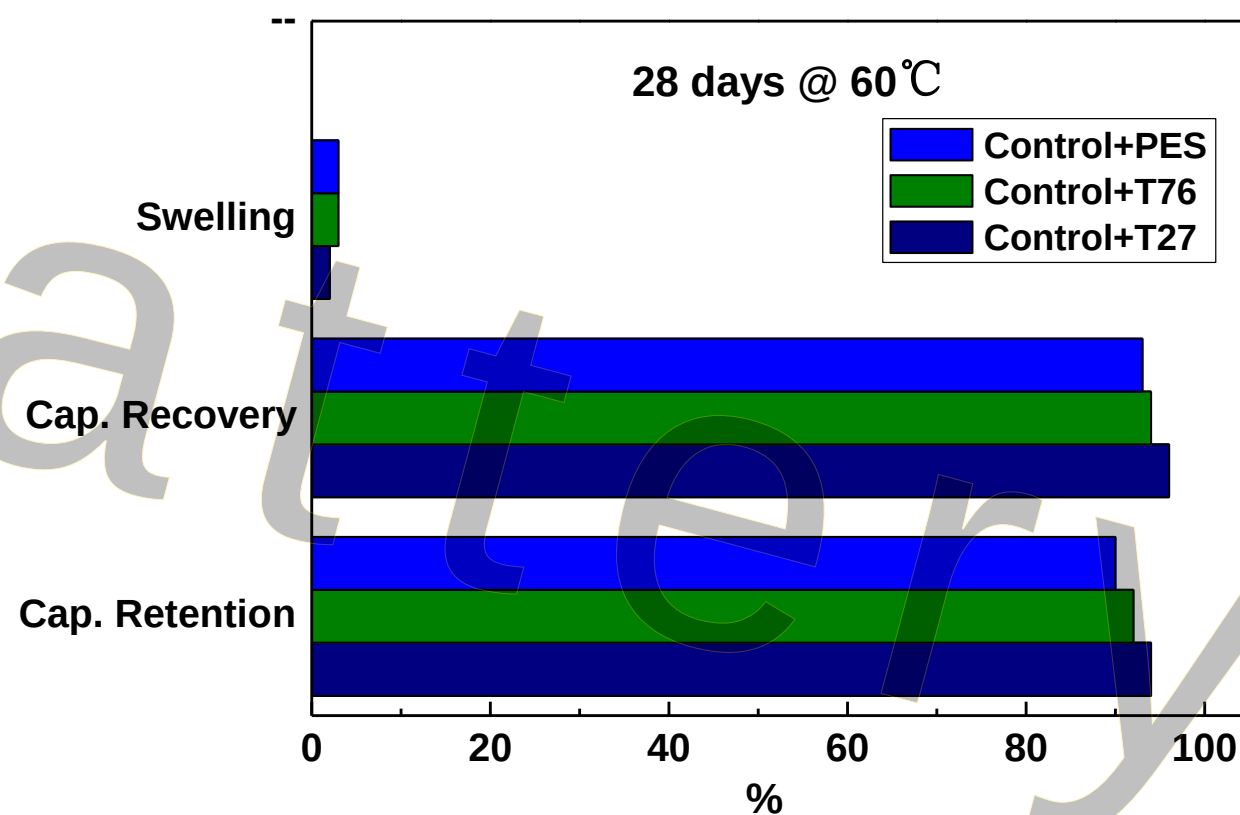
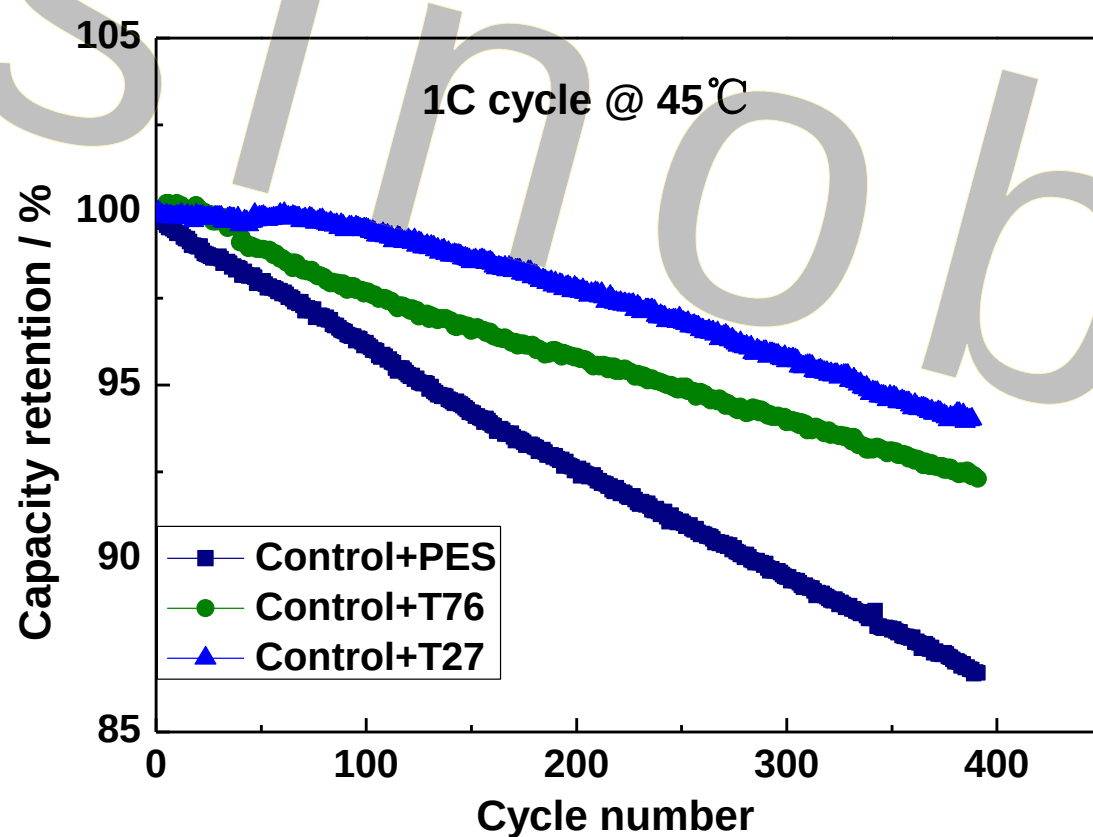
如何寻找合适的CEI添加剂呢？



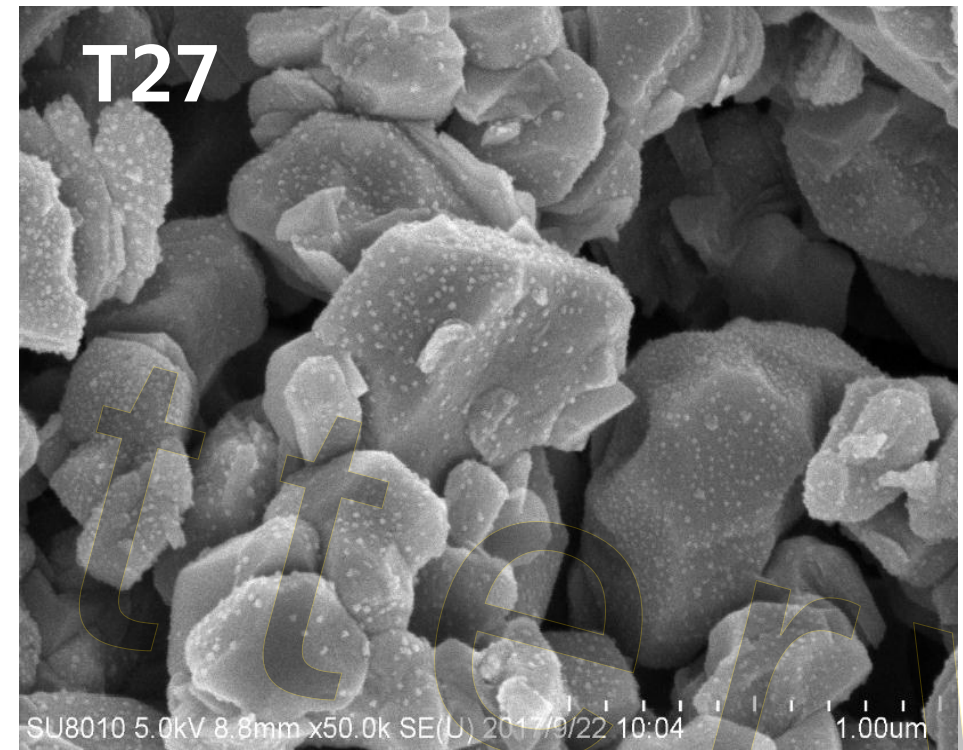
在Hi-Ni材料上，PES的效果要明显优于PS

NCA/AG, 505462 pouch-2.0Ah

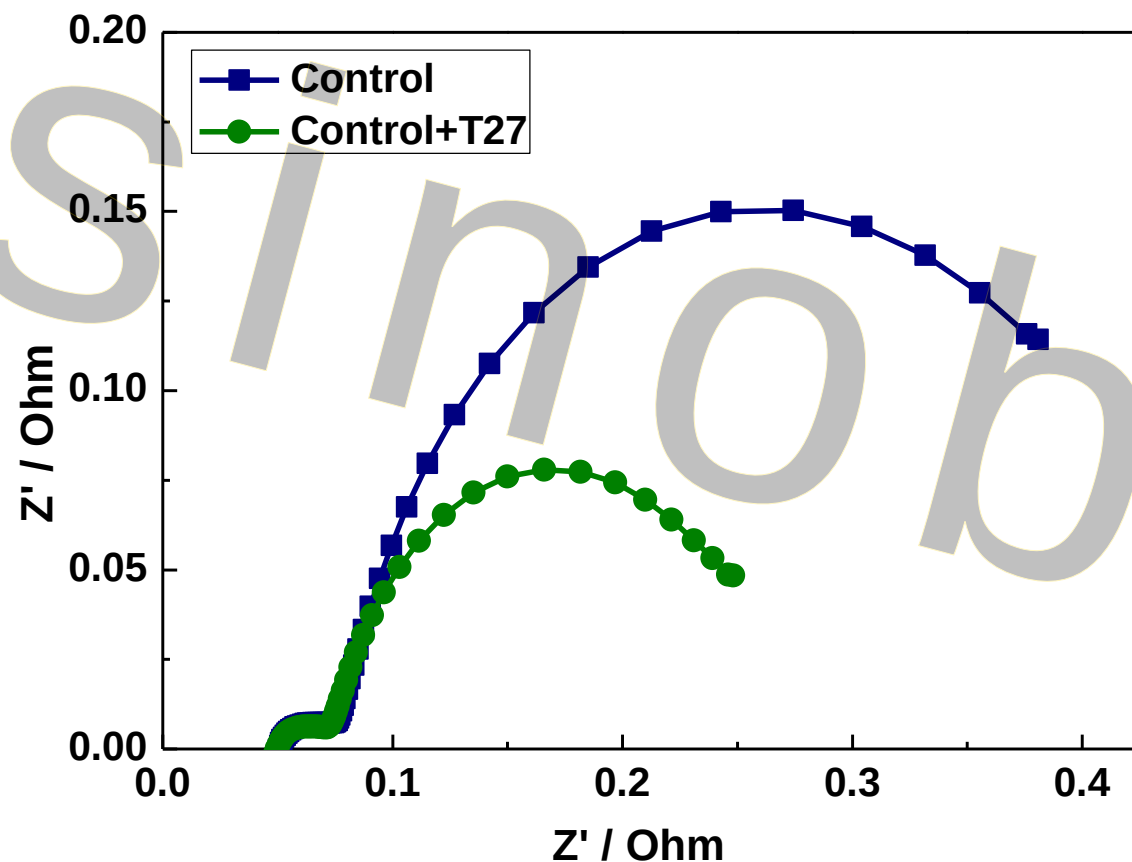
Electrolyte Control : EC/EMC/DEC=3/5/2, LiPF₆: 1.1M, DTD/PS



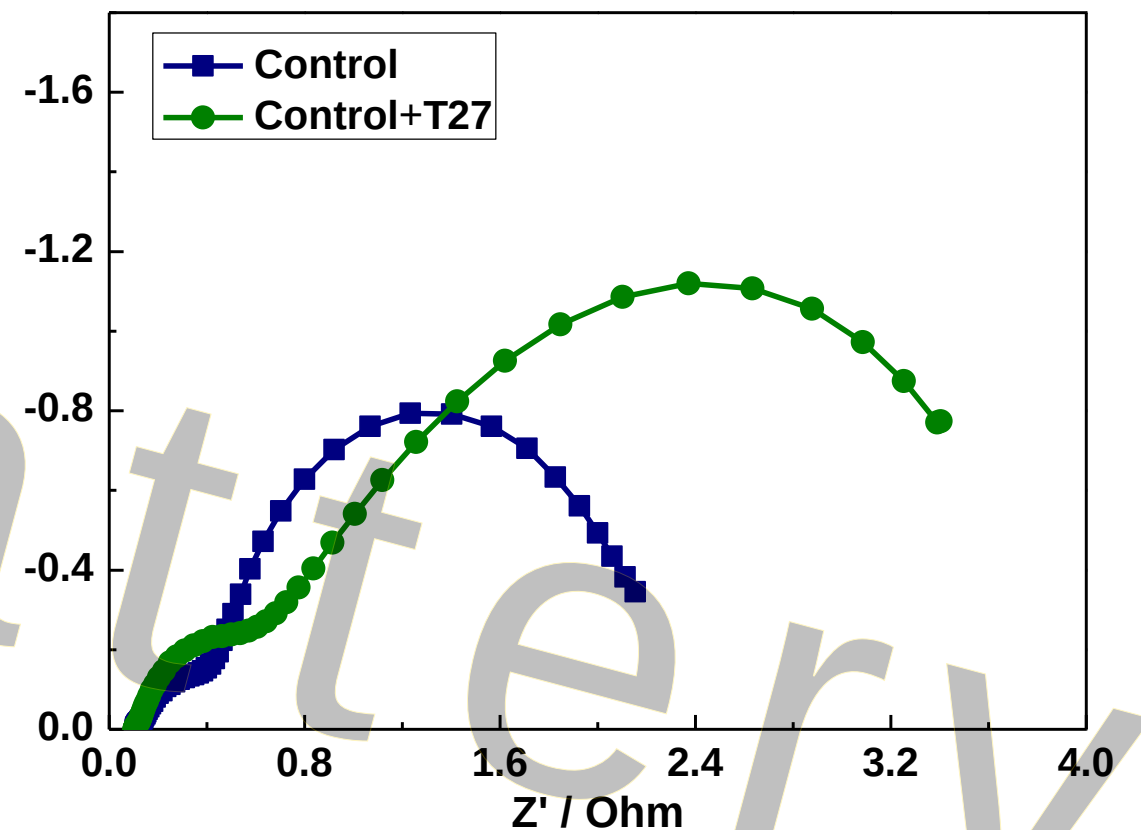
SEM of NCA cathode after 400 cycle @ 45°C



添加剂T27在正极形成钝化点/膜，阻止电解液在NCA上持续分解

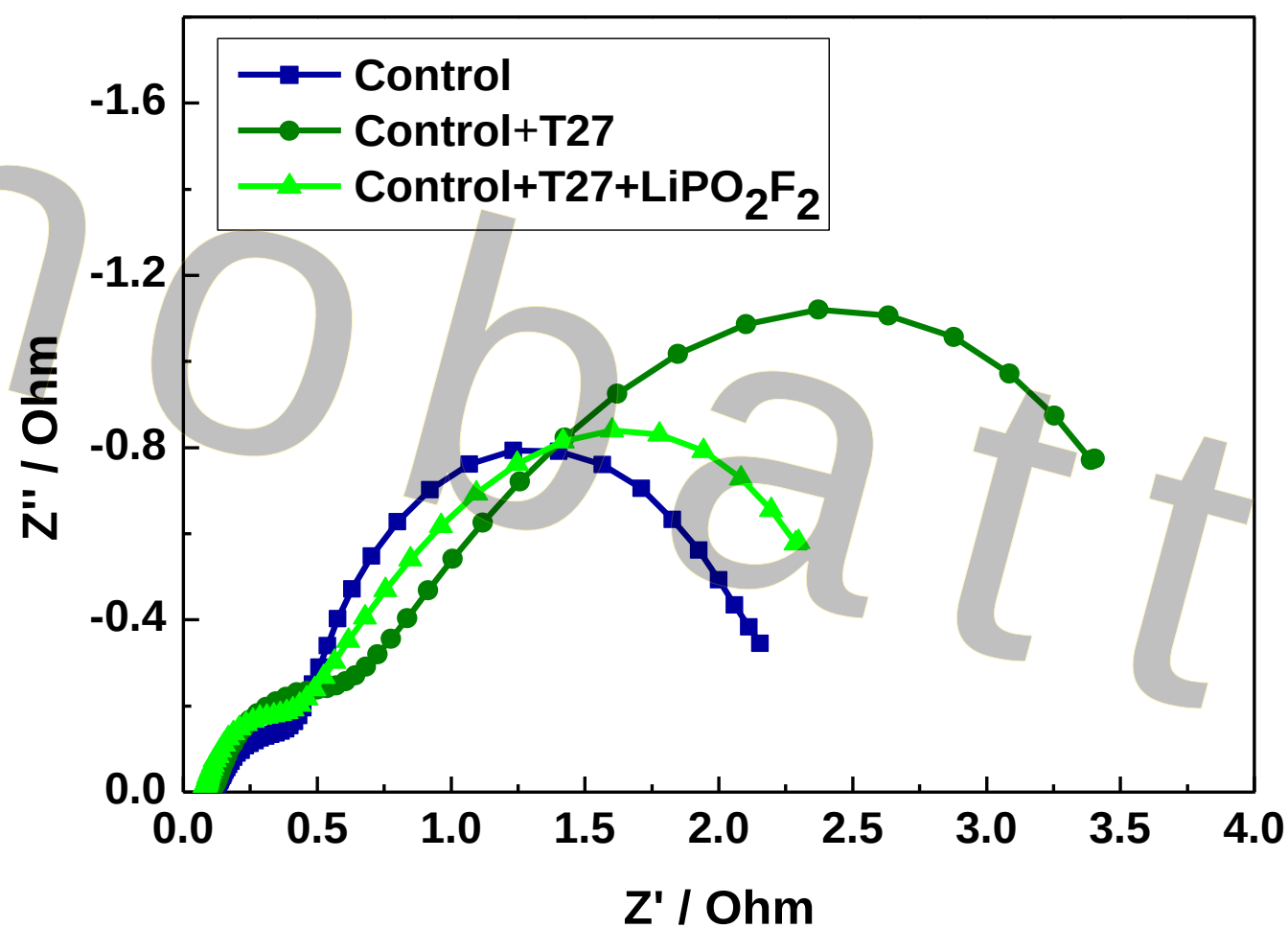


EIS of NCA/AG cell after 400 cycle @ 45°C



EIS of NCA/AG cell @ -10°C

T27能明显降低NCA/AG电池高温循环后的阻抗，但使初始低温阻抗上升

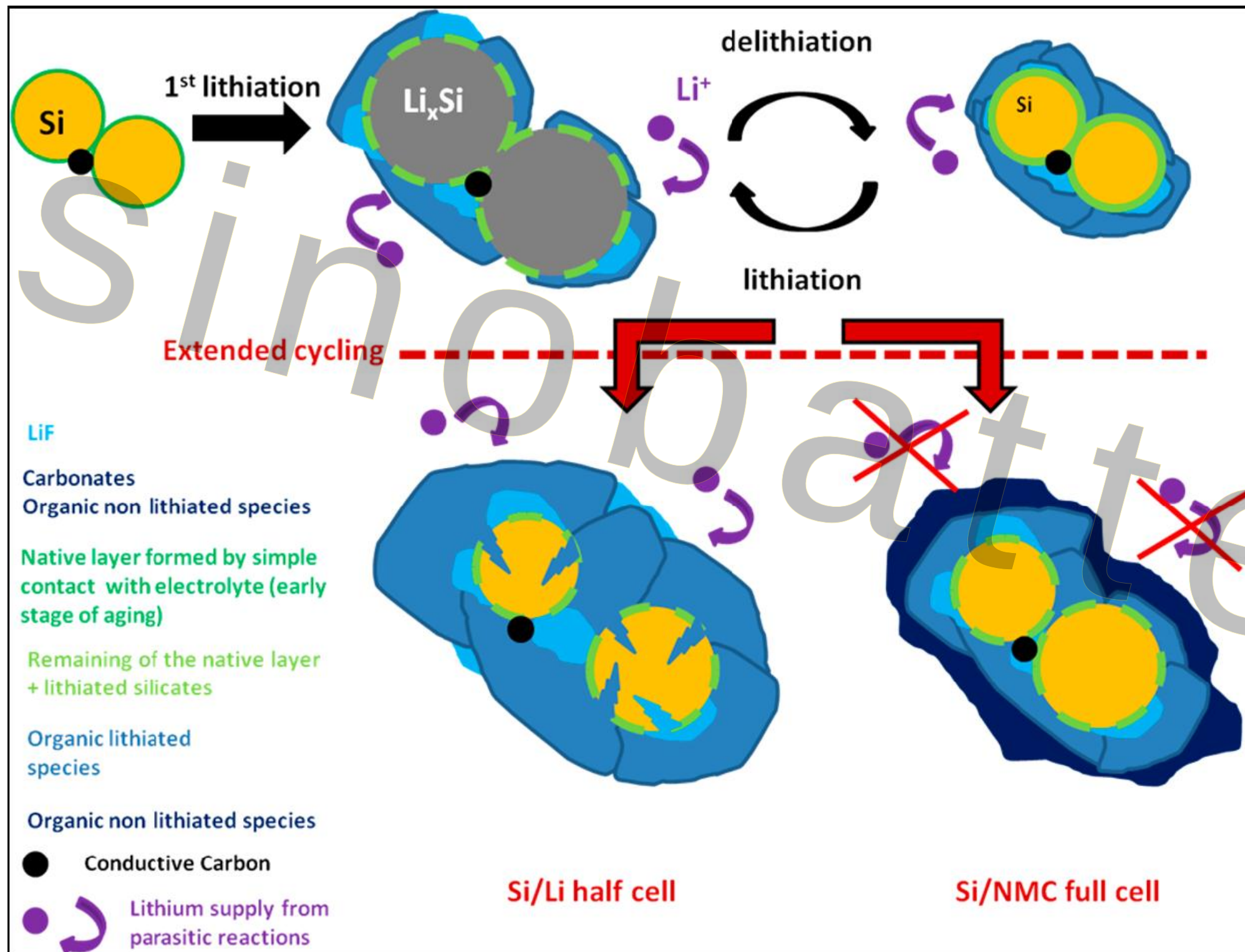


EIS of NCA/AG cell @ -10°C

Hi-Ni电池性能劣化的主要原因是正极对电解液的氧化产气；

不饱和T27与 LiPO_2F_2 搭配使用可以显著改善Hi-Ni电池性能

那么，作为高能量密度电池的负极Si/C，性能又如何呢？

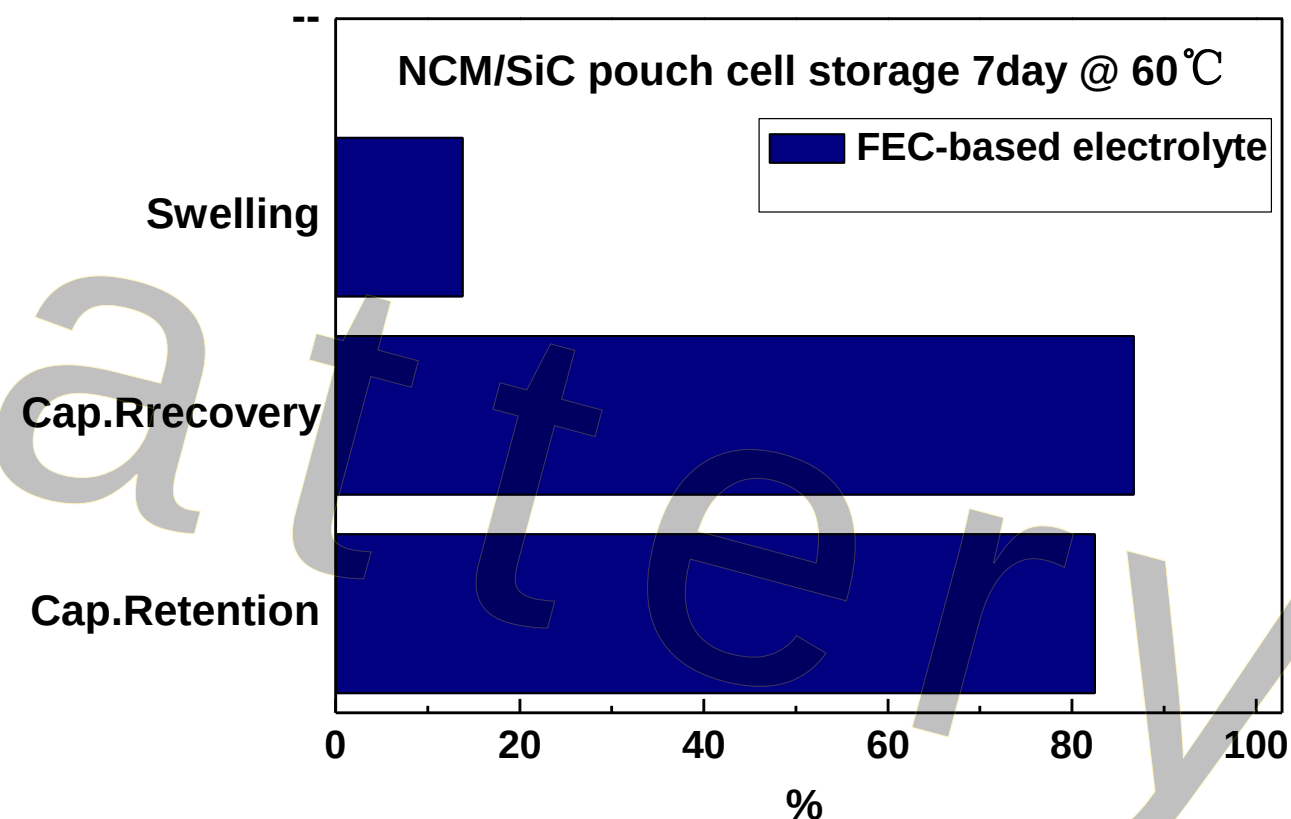
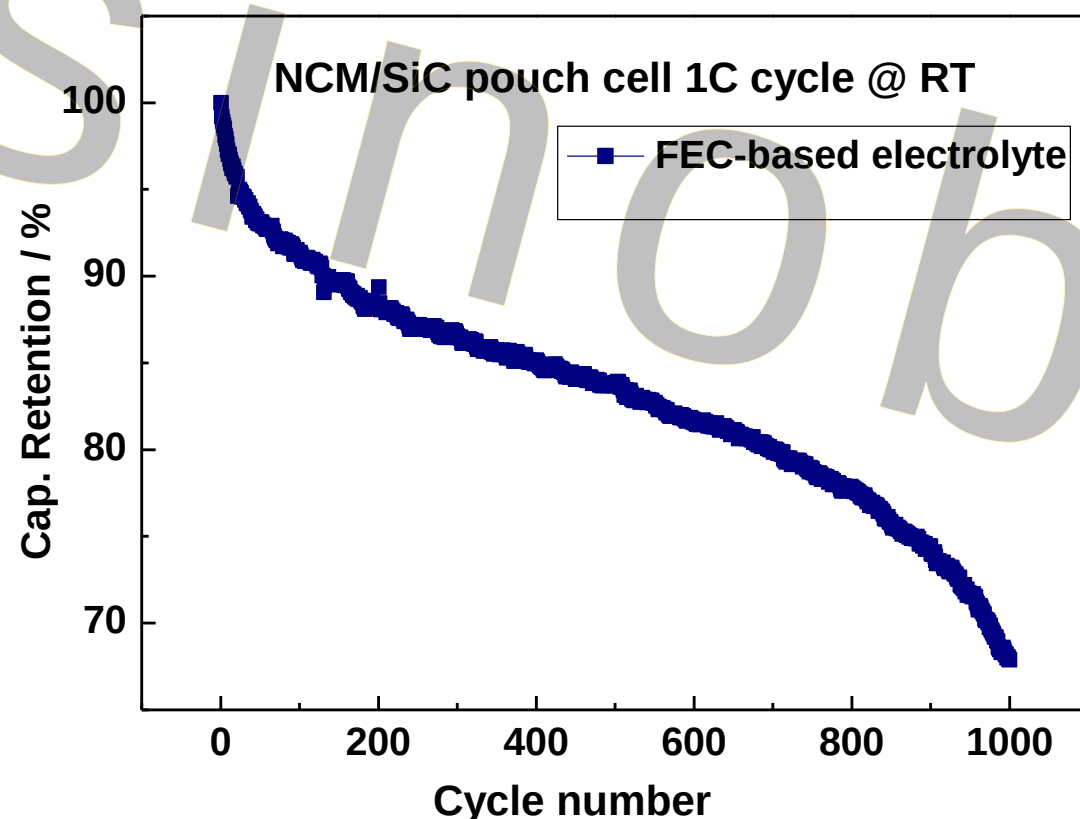


1、硅负极嵌锂体积膨胀大，硅材料和表面SEI膜容易破损；

2、硅形成SEI膜持续消耗活性锂，不可逆容量高

NCM523/SiC450 , 505462 pouch-1.9Ah

Electrolyte : EC/EMC/DEC=3/5/2 , LiPF₆: 1.1M , FEC , PS



1

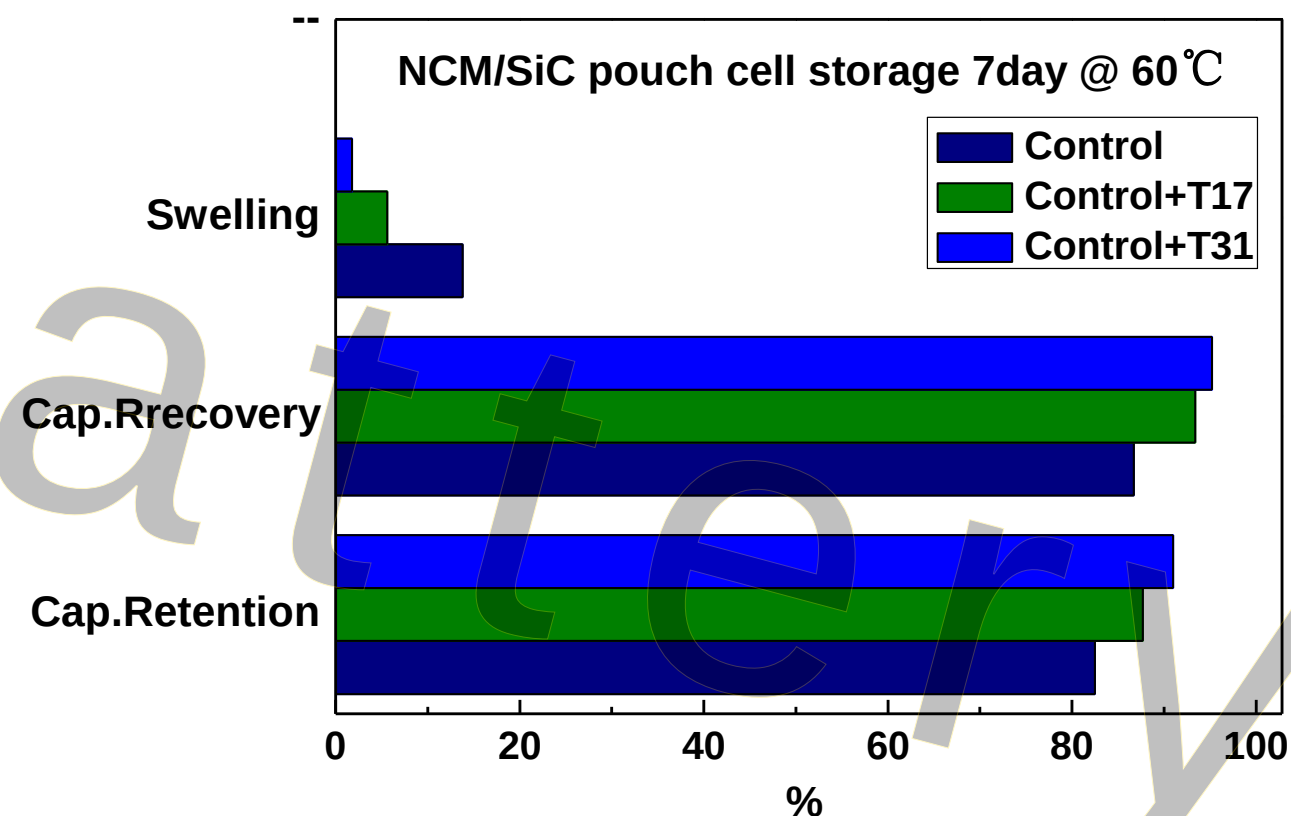
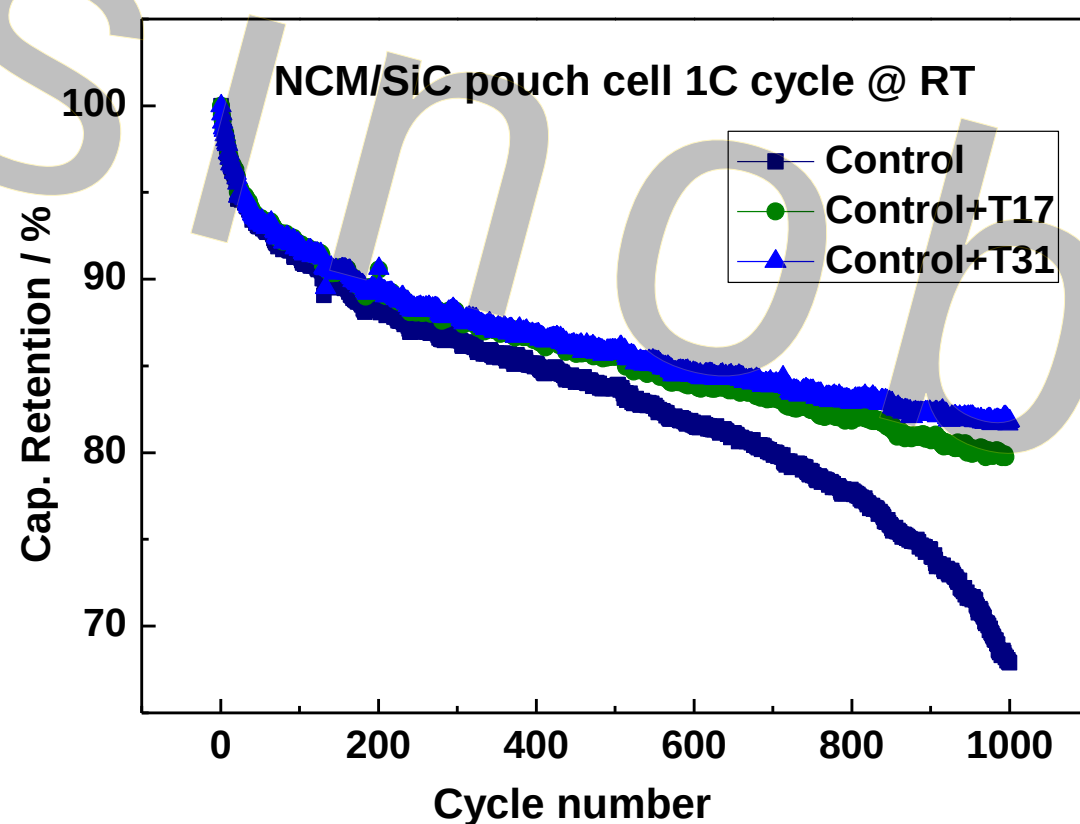
在FEC基电解液基础上添加高温成膜剂

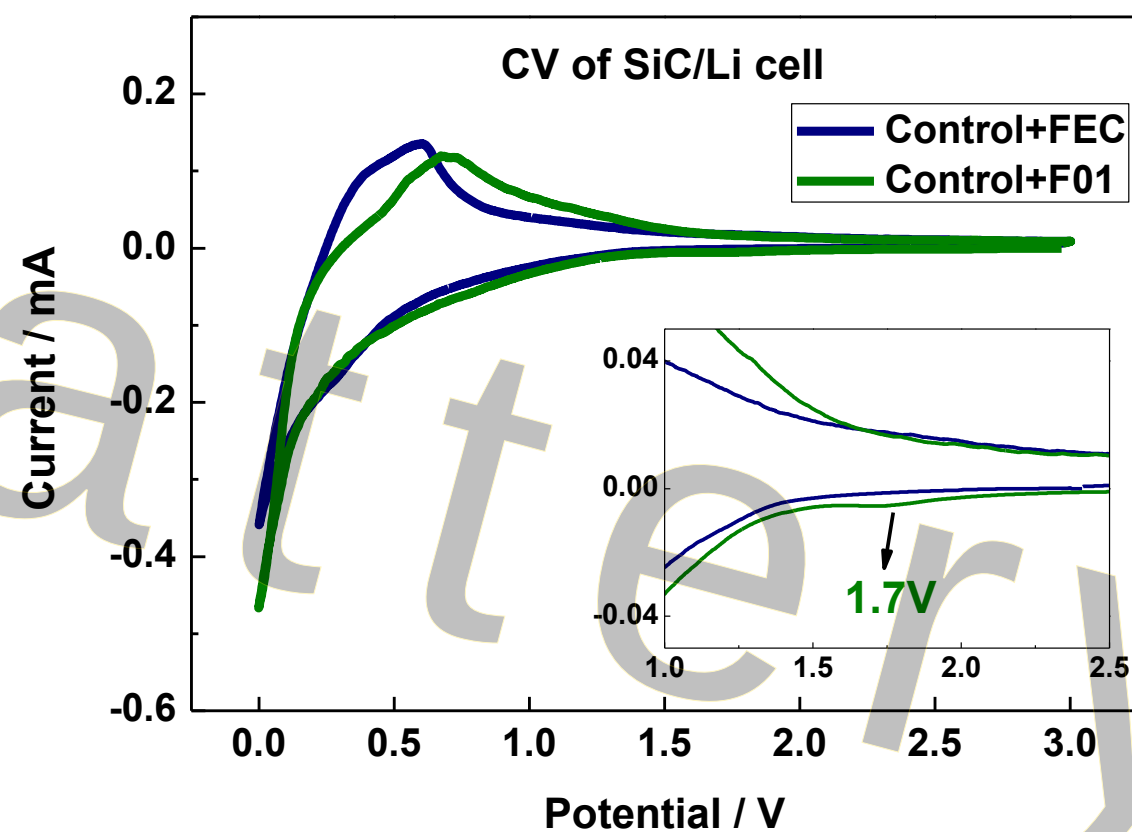
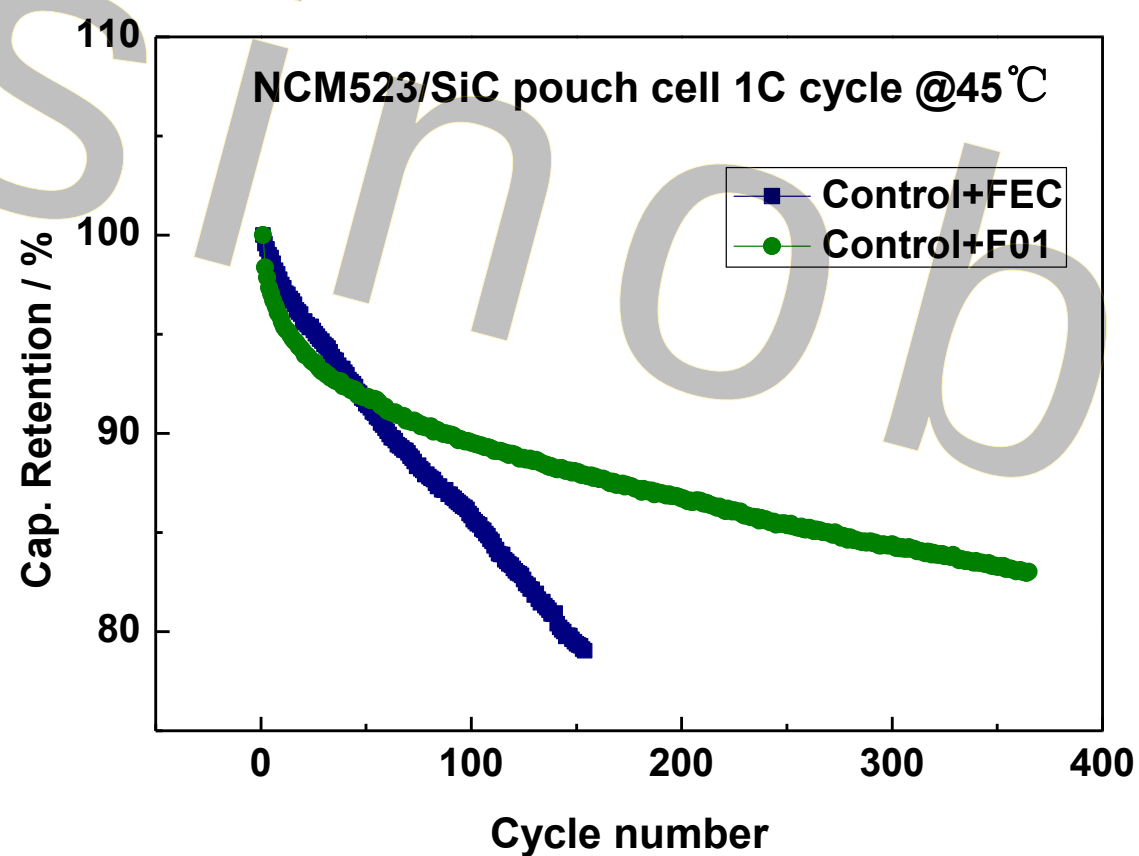
2

换掉FEC，不用

NCM523/SiC450 , 505462 pouch-1.9Ah

Electrolyte : EC/EMC/DEC=3/5/2 , LiPF₆: 1.1M , FEC , PS



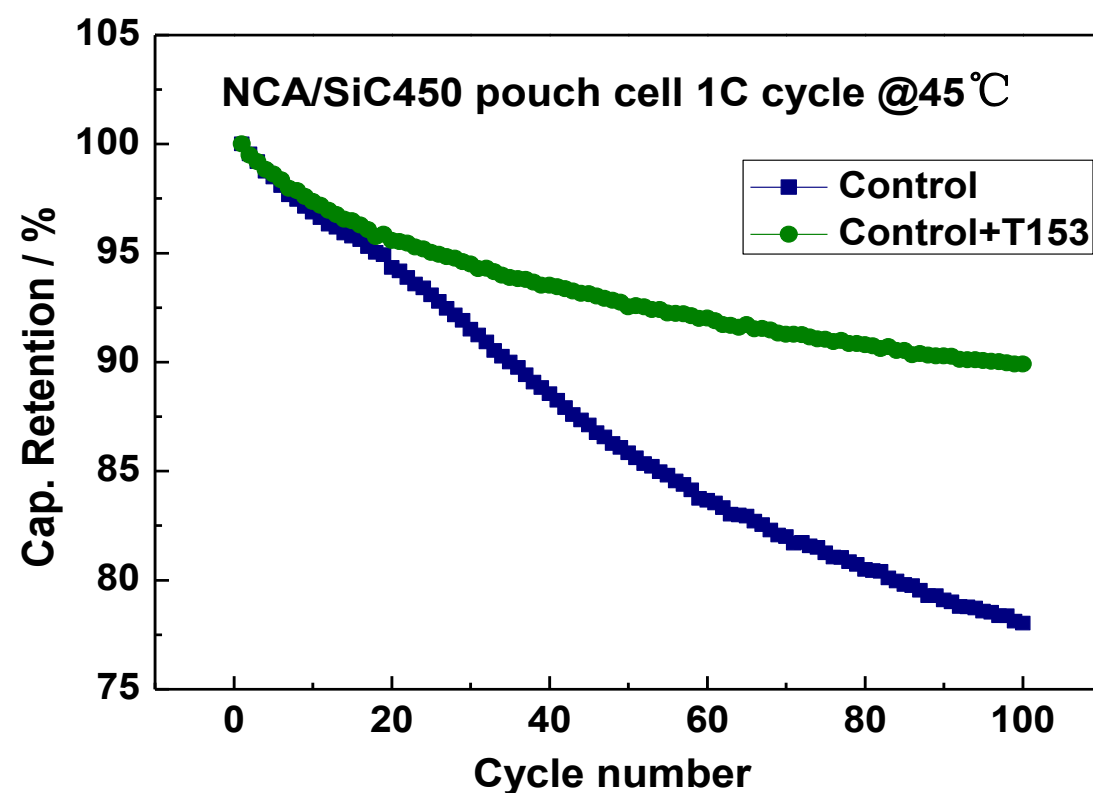
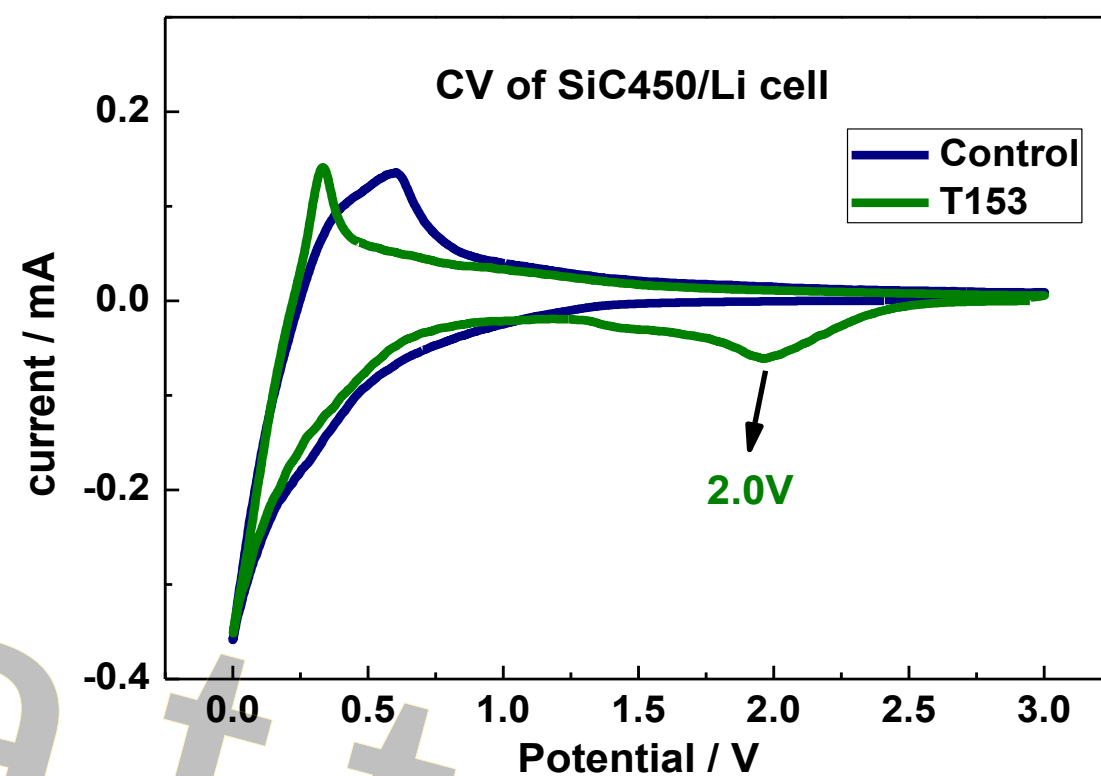
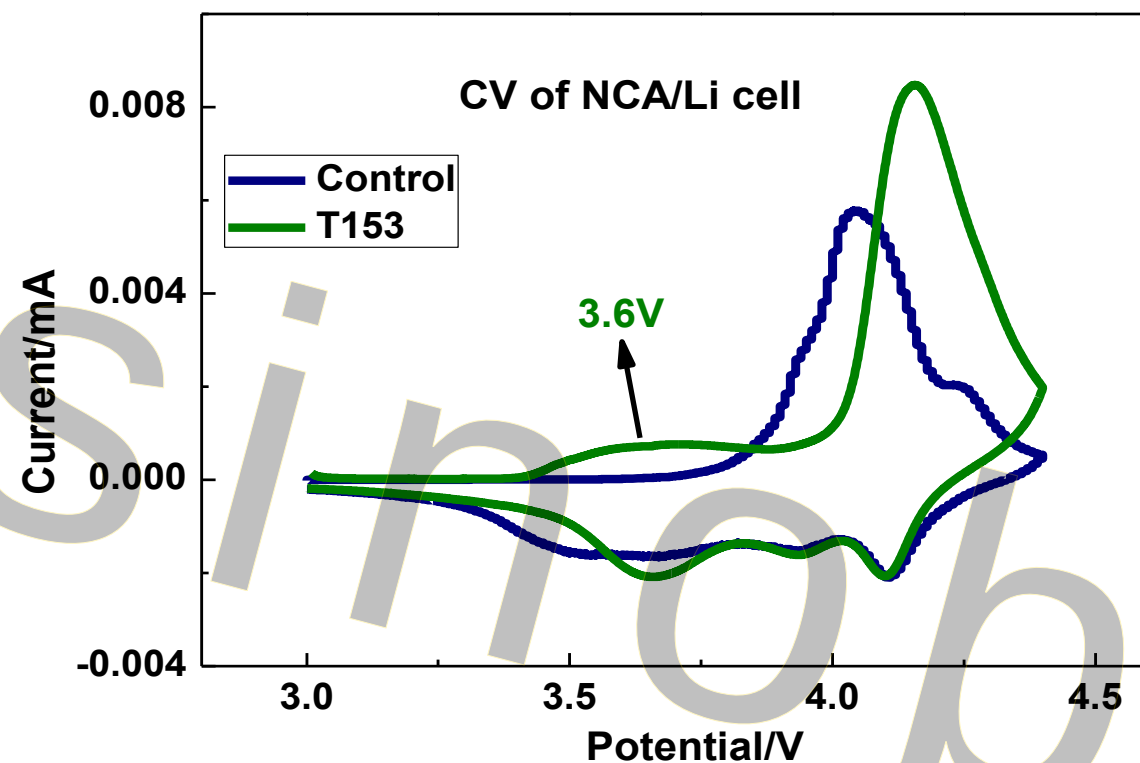


能否结合T27和M31的有效官能团，合成一种既在Hi-Ni正极形成CEI，又在Si/C形成SEI的添加剂呢？

4

Hi-Ni+Si/C

T153能有效改善高温循环



T153分别在3.6V和2.0V左右有成膜峰

5

Conclusion

Hi-Ni

T27+LiPO2F2

Si/C

FEC+T31

F01

T153

Hi-Ni
+
Si/C

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135-7038-3416



zhoushaoyun@tinci.com

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