

# 04 实验素材库-笔记

## 1. 作用

### 1.1 提供实验方案和操作细节

通过对文献的实验部分进行摘录和整理，素材库可以提供详细的实验方案和操作细节，避免在实验过程中反复查找文献，节约时间和精力。

### 1.2 提高实验效率

通过参考素材库中的实验步骤和参数设置，可以更快地完成实验操作，减少实验过程中的试错成本。

### 1.3 确保实验可重复性

素材库可以帮助研究者更好地理解和掌握实验方法，提高实验的可重复性，增强研究结果的可信度。

### 1.4 启发实验设计思路

通过对比和分析不同文献的实验方案，**可能会发现新的实验方法或思路**，为实验设计提供新的方向。

## 2. 操作步骤

### 2.1 实验素材摘录

#### 2.1.1 文献分组

- 对文献进行分组，将研究主题或实验方法相似的文献归类到一起
- 例如，可以根据材料制备方法、表征手段、性能测试等进行分组

#### 2.1.2 创建"实验素材摘录1"文档

- 新建一个Word文档，命名为"实验素材摘录1"

#### 2.1.3 从EndNote中导出文献列表

- 在EndNote中选择与研究主题相关的文献，将其导出为txt格式
- 选择"J Alloys Compounds-full name.ens"输出样式，并将其保存到EndNote安装目录中的Styles目录中

#### 2.1.4 粘贴文献信息

- 将导出的txt文件中的文献列表复制到"实验素材摘录1"文档中
- 将所有文献信息设置为标题2格式

## 2.1.5 添加摘录

- 在每个文献信息下方，复制该文献实验部分中与研究主题相关的关键步骤、参数设置和实验条件等信息
- 对摘录内容进行编号

## 2.1.6 标签化

- 为每条摘录添加一个简短的中文标签，概括其主要内容
- 例如，可以将摘录"将1克活性物质、0.75克Super P和0.25克PVDF溶解在NMP中，搅拌12小时形成均匀的浆料"的标签设置为"浆料制备-配比"
- 可借助AI工具**，对实验部分进行标签化处理

The screenshot shows a Microsoft Word document titled "1-5# 文字素材库 实验摘录 1.docx". The ribbon menu is visible at the top, showing tabs like '开始' (Start), '插入' (Insert), '设计' (Design), etc. On the left, there's a '导航' (Navigation) pane with a search bar and tabs for '标题' (Title), '页面' (Page), and '结果' (Results). The main content area displays a list of references and some extracted text.

**References:**

- [1] L. Wang, B. Zhang, Y. Hu, X. Li, T. Z...
- [2] S. Sun, T. Guan, B. Shen, K. Leng, Y...
- [3] D. Ren, X. Feng, L. Lu, X. He, M. Ou...
- [4] T. Ma, S. Wu, F. Wang, J. Lacap, C....
- [5] Y. Zhao, Y. Patel, I.A. Hunt, K.M. Ka...
- [6] S. Zhao, L. Zhang, G. Zhang, H. Sun...
- [7] V. Vanpeene, J. Villanova, A. King,...
- [8] F. Shi, Z. Song, P.N. Ross, G.A. So...
- [9] L. Qie, C. Zu, A. Manthiram, A High...
- [10] J.B. Robinson, T.M.M. Heenan, J....

**Extracted Text (highlighted by a red box):**

[1] L. Wang, B. Zhang, Y. Hu, X. Li, T. Zhao, Failure analysis of LiNi0.83Co0.12Mn0.05O2/graphite-SiO<sub>x</sub> pouch batteries cycled at high temperature, *Journal of Power Sources* 482 (2021).

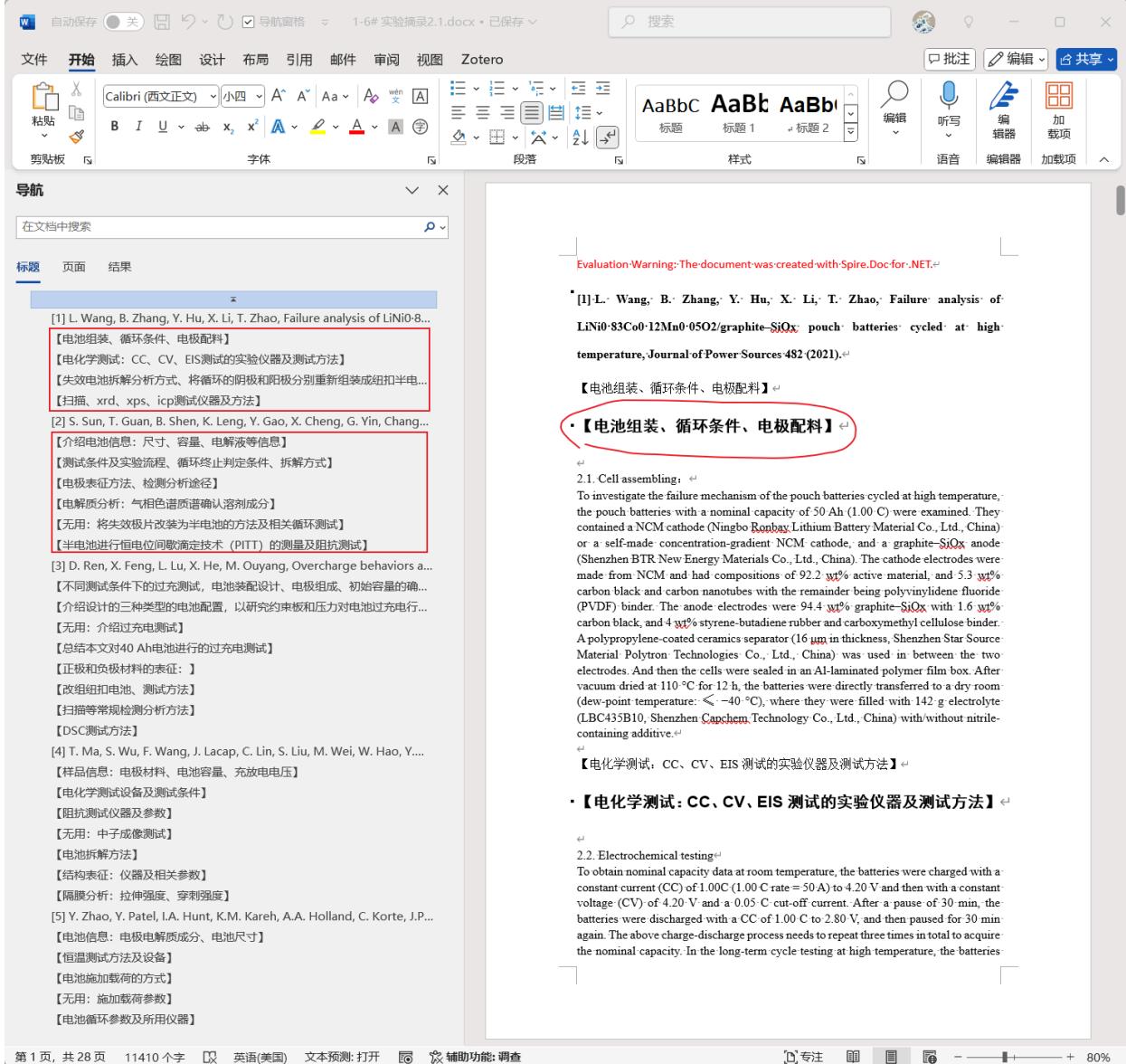
**【电池组装、循环条件、电极配料】**  
2.1. Cell assembling.  
To investigate the failure mechanism of the pouch batteries cycled at high temperature, the pouch batteries with a nominal capacity of 50 Ah (1.00 C) were examined. They contained a NCM cathode (Ningbo Ronbay Lithium Battery Material Co., Ltd., China) or a self-made concentration-gradient NCM cathode, and a graphite-SiO<sub>x</sub> anode (Shenzhen BTR New Energy Materials Co., Ltd., China). The cathode electrodes were made from NCM and had compositions of 92.2 wt% active material, and 5.3 wt% carbon black and carbon nanotubes with the remainder being polyvinylidene fluoride (PVDF) binder. The anode electrodes were 94.4 wt% graphite-SiO<sub>x</sub> with 1.6 wt% carbon black, and 4 wt% styrene-butadiene rubber and carboxymethyl cellulose binder. A polypropylene-coated ceramics separator (16 μm in thickness, Shenzhen Star Source Material Polytron Technologies Co., Ltd., China) was used in between the two electrodes. And then the cells were sealed in an Al-laminated polymer film box. After vacuum dried at 110 °C for 12 h, the batteries were directly transferred to a dry room (dew-point temperature: < -40 °C), where they were filled with 142 g electrolyte (LBC435B10, Shenzhen Capchem Technology Co., Ltd., China) with/without nitrile-containing additive.

**【电化学测试：CC、CV、EIS 测试的实验仪器及测试方法】**  
2.2. Electrochemical testing.  
To obtain nominal capacity data at room temperature, the batteries were charged with a constant current (CC) of 1.00C (1.00 C rate = 50 A) to 4.20 V and then with a constant voltage (CV) of 4.20 V and a 0.05 C cut-off current. After a pause of 30 min, the batteries were discharged with a CC of 1.00 C to 2.80 V, and then paused for 30 min again. The above charge-discharge process needs to repeat three times in total to acquire the nominal capacity. In the long-term cycle testing at high temperature, the batteries were charged with a CC of 1.00 C to 4.15 V and then with a CV of 4.15 V and a 0.05 C cut-off current. After a pause of 30 min, the batteries were discharged with a CC of 1.00 C to 3.00 V. All the charge & discharge measurements were carried out on LANHE CT2017F instrument (Wuhan Blue Electronics Co. Ltd., China) and thermostat (KSON Instrument Technology Co. Ltd., China). A partial state of charge (PSOC) condition of batteries was achieved by charging batteries with a CC of 1.00 C to 3.80 V and then with a CV of 3.80 V and a 0.05 C cut-off current. Under the PSOC condition, the alternating current (AC) internal resistances, thicknesses, and electrochemical impedance spectra (EIS) of batteries were measured by using battery tester (HIOKI BT3562), digital caliper (Mitutoyo 500-151-30 CD-15AX), and an

## 2.2 生成系列文件

### 2.2.1 实验素材摘录2.1

- 复制"实验素材摘录1"并进行格式调整
- 将每个标签重复复制一次，第二个标签独立占据一行，并设置为标题2格式
- 这样可以方便后续的剪切和粘贴操作



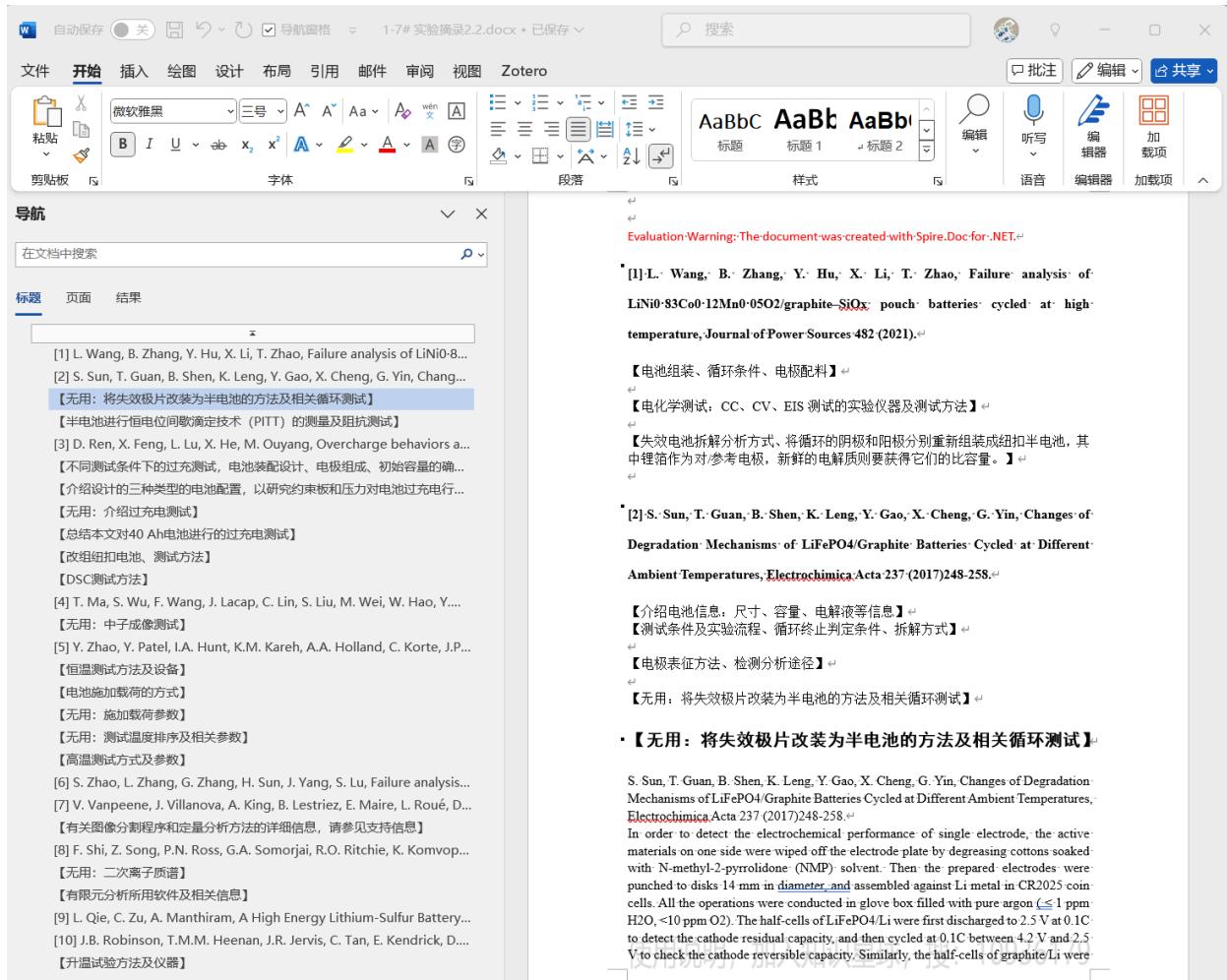
### 2.2.2 实验素材摘录2.2

- 复制"实验素材摘录2.1"并命名为"实验素材摘录2.2"

### 2.2.3 实验素材摘录2.3

- 回顾"实验素材摘录2.2"中的所有内容，包括文献信息、摘录内容以及添加的标签
- 创建新文档，命名为"实验素材摘录2.3"
- 根据实验步骤和材料类型，从"实验素材摘录2.2"中提取主要内容作为一级标题
- 在每个一级标题下，从"实验素材摘录2.2"中找到相关的标签作为二级标题

- 将二级标题对应的摘录内容剪切粘贴到相应位置



- 组织和完善内容：

- 调整摘录内容的顺序，使其更符合逻辑
- 对摘录内容进行适当修改，使其更符合表达习惯

- 确保每个一级标题下的内容都与该标题相关

The screenshot shows a Microsoft Word document with a navigation pane on the left. The navigation pane has sections for '标题' (Title), '页面' (Page), and '结果' (Results). Below these are several collapsed sections like '【电池组装、循环条件、电极配料】' and '【样品信息：电极材料、电池容量、充放电电压】'. One section, '【袋式电池组装方法：电极制备、成分】', is expanded, showing a numbered list from 1.1 to 3.13. To the right of the navigation pane, the main content area displays a specific sample information entry. It includes a title '1.2. 【样品信息：电极材料、电池容量、充放电电压】', a reference to a paper by T. Ma et al., and a detailed description of the battery's composition and performance parameters.

**1.2. 【样品信息：电极材料、电池容量、充放电电压】**

T. Ma, S. Wu, F. Wang, J. Lacap, C. Lin, S. Liu, M. Wei, W. Hao, Y. Wang, J.W. Park, Degradation Mechanism Study and Safety Hazard Analysis of Oxidized discharge on Commercialized Lithium-ion Batteries, ACS Applied Materials and Interfaces 12 (2020) 56086–56094.<sup>a</sup>  
Sample Information<sup>a</sup>  
18.650-type NCM batteries were purchased as tested samples, which consist of a LiNi<sub>1/3</sub>Co<sub>1/3</sub>Mn<sub>1/3</sub>O<sub>2</sub> cathode and a graphite anode. The rated capacity and rated voltage of the NMC batteries were 2.5 Ah and 3.6 V, respectively, and the limited charge-discharge voltage 4.15–2.75 V.<sup>a</sup>

**1.3. 【电池信息：电极电解质成分、电池尺寸】**

Y. Zhao, Y. Patel, I.A. Hunt, K.M. Karch, A.A. Holland, C. Korte, J.P. Dear, Y. Yue, G.J. Offer, Preventing lithium-ion battery failure during high temperatures by externally applied compression, Journal of Energy Storage 13 (2017) 296–303.<sup>a</sup>  
The 5 Ah high power pouch cell used for this work is manufactured by Kokam (Model: SLPB11543140H5). The cell contains a graphite anode, LiMnNiO<sub>2</sub> (NCM) cathode. According to the specification sheet the electrolyte consists of a solution of LiPF<sub>6</sub> in a mixture of organic solvent Ethylene Carbonate (EC) and Ethylmethyl Carbonate (EMC). The cell has a dimension of L 140 x W 42 x T 11.4 mm.<sup>a</sup>

**1.4. 【袋式电池组装方法：电极制备、成分】**

S. Zhao, L. Zhang, G. Zhang, H. Sun, J. Yang, S. Lu, Failure analysis of pouch-type Li-O<sub>2</sub> batteries with superior energy density, Journal of Energy Chemistry 45 (2020) 74–82.<sup>a</sup>  
Although carbon-based air electrodes are unstable when charged in excess of 3.5 V [37,38], they are still good options for the optimization of pouch-type cell construction considering their light-weight and low cost. Super P based air electrodes were fabricated via a spray coating method, as shown in Fig. 1(a). The cathode (air electrode) was fabricated as follows: Super P powder and a suspension of PTFE (polytetrafluoroethylene) in water (60% solid) were added together according to a specific gravimetric ratio (Super P-PTFE = 8:2). The mixture was mechanically stirred for 30 min to form a slurry. The slurry was sprayed on the current collector using a pneumatic nozzle. A 55 μm thick aluminum mesh (8.4 mg cm<sup>-2</sup>) was used as the cathode current collector and the holes of the mesh ensured the ingress and exit of

## 3. 与引言素材库的对比

### 3.1 关注点不同

- 引言素材库：标签化时更侧重于概括文献的研究背景、研究目的、主要内容和研究方法等方面的信息
- 实验素材摘录：标签化时更侧重于概括文献中与实验步骤、参数设置、实验条件等相关的具体信息

### 3.2 标签内容的侧重点不同

- 引言素材库：标签内容可以相对简洁，重点在于快速了解文献的核心内容和写作脉络
- 实验素材摘录：标签内容需要更加具体，需要准确地概括摘录的关键信息，例如具体的实验步骤、参数设置、试剂用量等