

# Engineering cathode for limiting polysulfide shuttling in Lithium Sulfur batteries

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## Introduction

- Lithium sulfur (LiS) batteries are high-energy rechargeable batteries that use Li as anode and S as cathode
- They possess high practical energy density up to 500 Wh/kg outperforming Li-ion batteries, 200 – 300 Wh/kg<sup>1</sup>

**Challenge:** Liquid phase conversion of sulfides allows dissolution of long-chain polysulfides (LiPSs) (shuttling effect). However, solid phase conversion prevents formation of long chain LiPSs

**Aim:** Immobilizing short chain polysulfides in pores of activated carbon (C) host to limit shuttling effect

**Strategy:** Carbon pore engineering and cathode electrolyte interface formation enabling solid phase conversion

## Methods

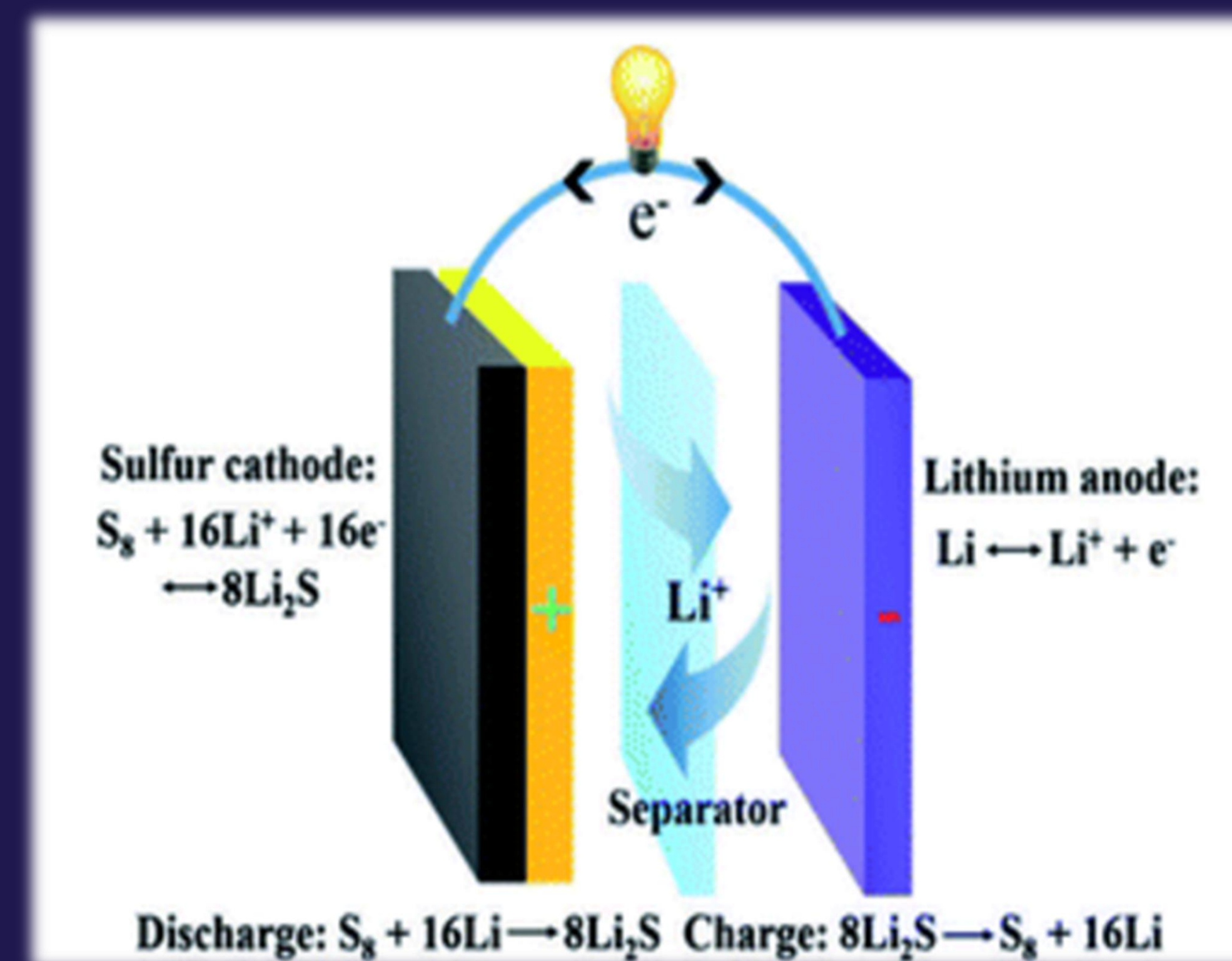
- Screening of carbon samples using BET and pore size distribution
- Melt infiltration of C & S (155°C, 21h)
- Positive electrode was prepared as a slurry mixture composition C/S:PVDF (90:10), using DMSO as a solvent
- Assembling 3-electrode Swagelok cell to evaluate electrochemical performance of C/S cathode

## Results

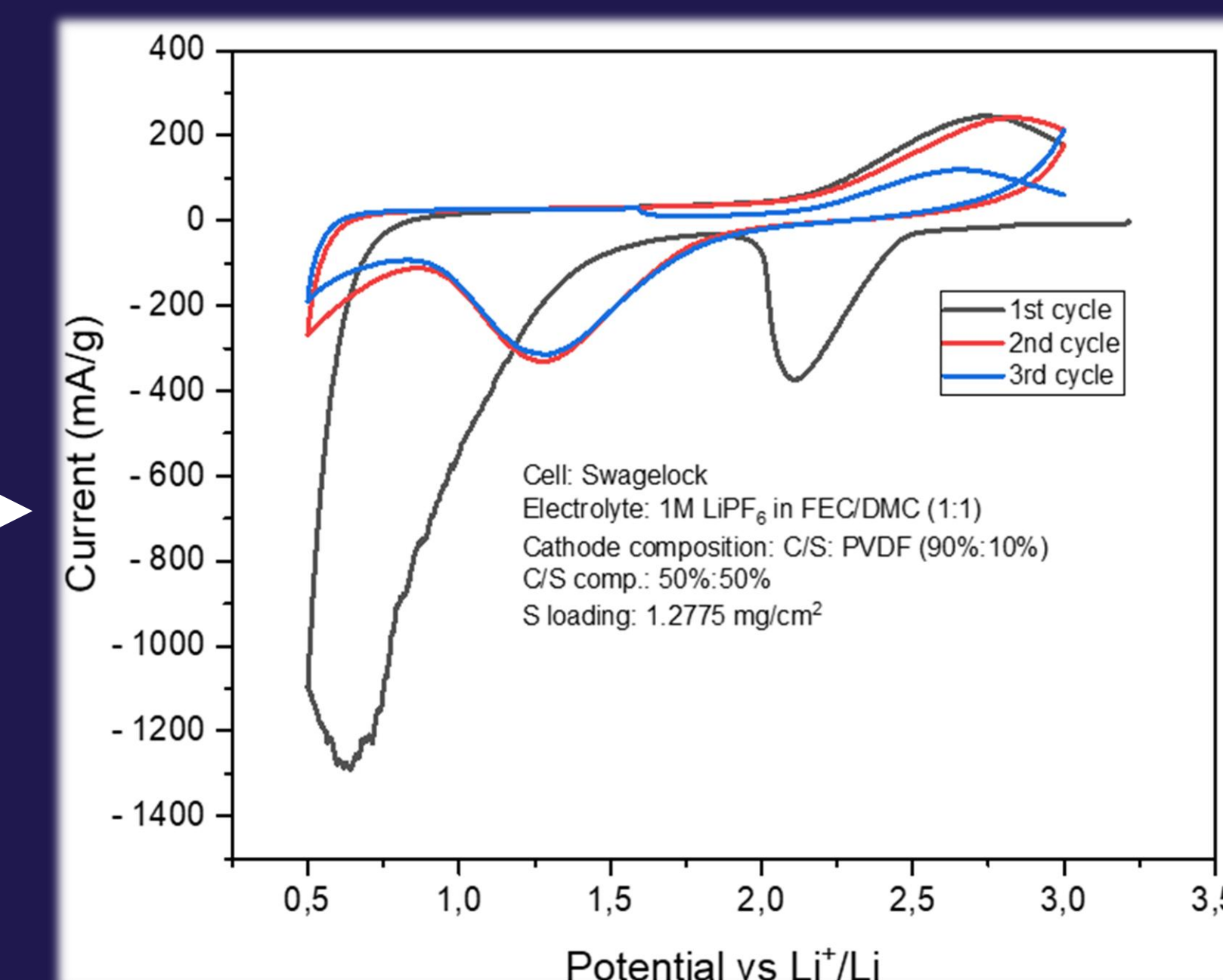
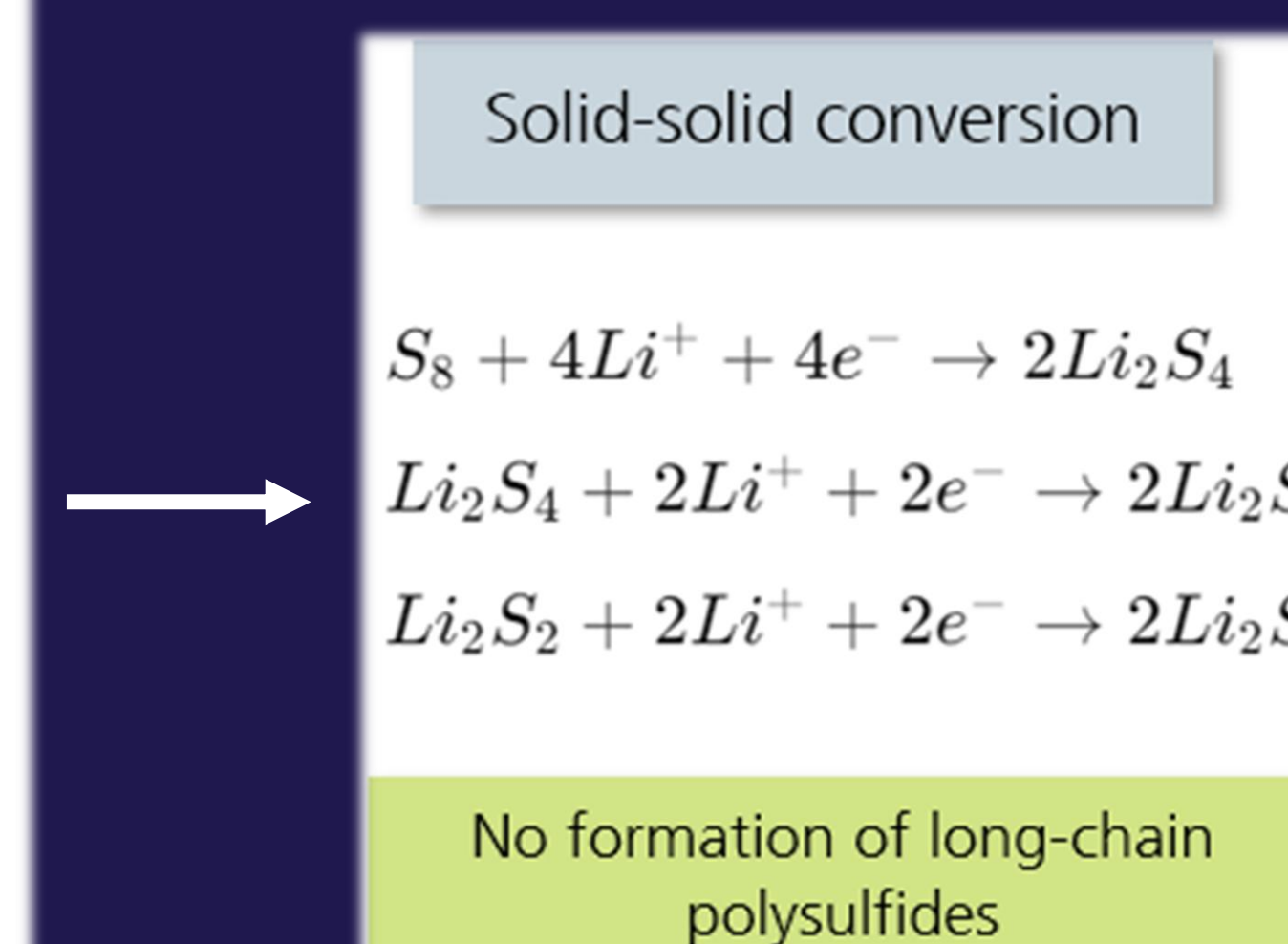
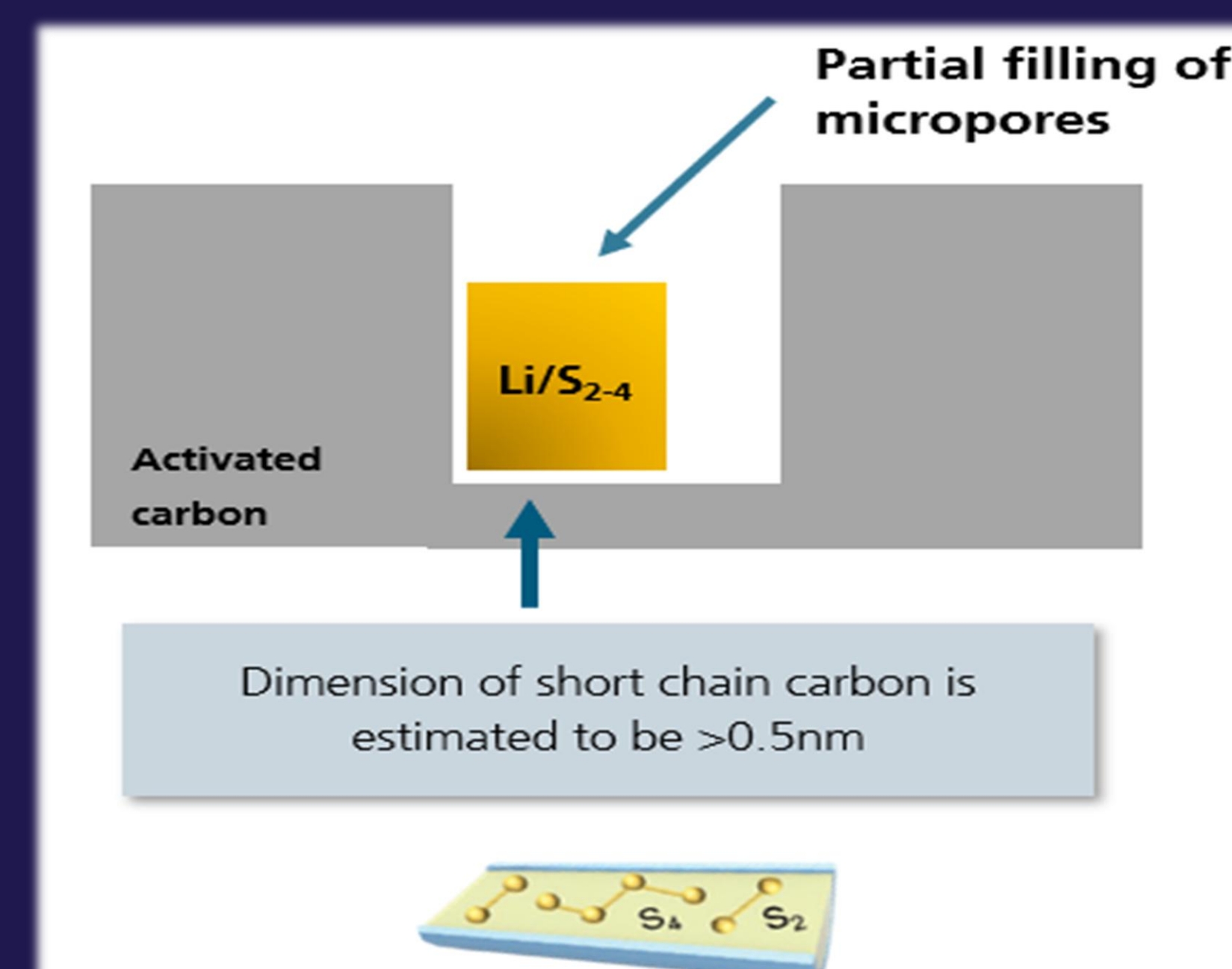
- Solid phase conversion achieved due to single redox peaks.
- High polarization between oxidation and reduction reactions, capacity loss due to parasitic reactions at the slow current rate (C/40)
- High resistance due to CEI formation after the first cycle

1 Zhao et al., ACS Cent. Sci. 2020, 6, 7, 1095–1104  
2 Kim et al., J. Mater. Chem. A, 2019, 7, 2942–2964

# Carbon host with micropores of 0.8nm hosts short chain polysulfides, enabling solid phase conversion



Schematic of Lithium sulfur battery with redox reaction<sup>2</sup>

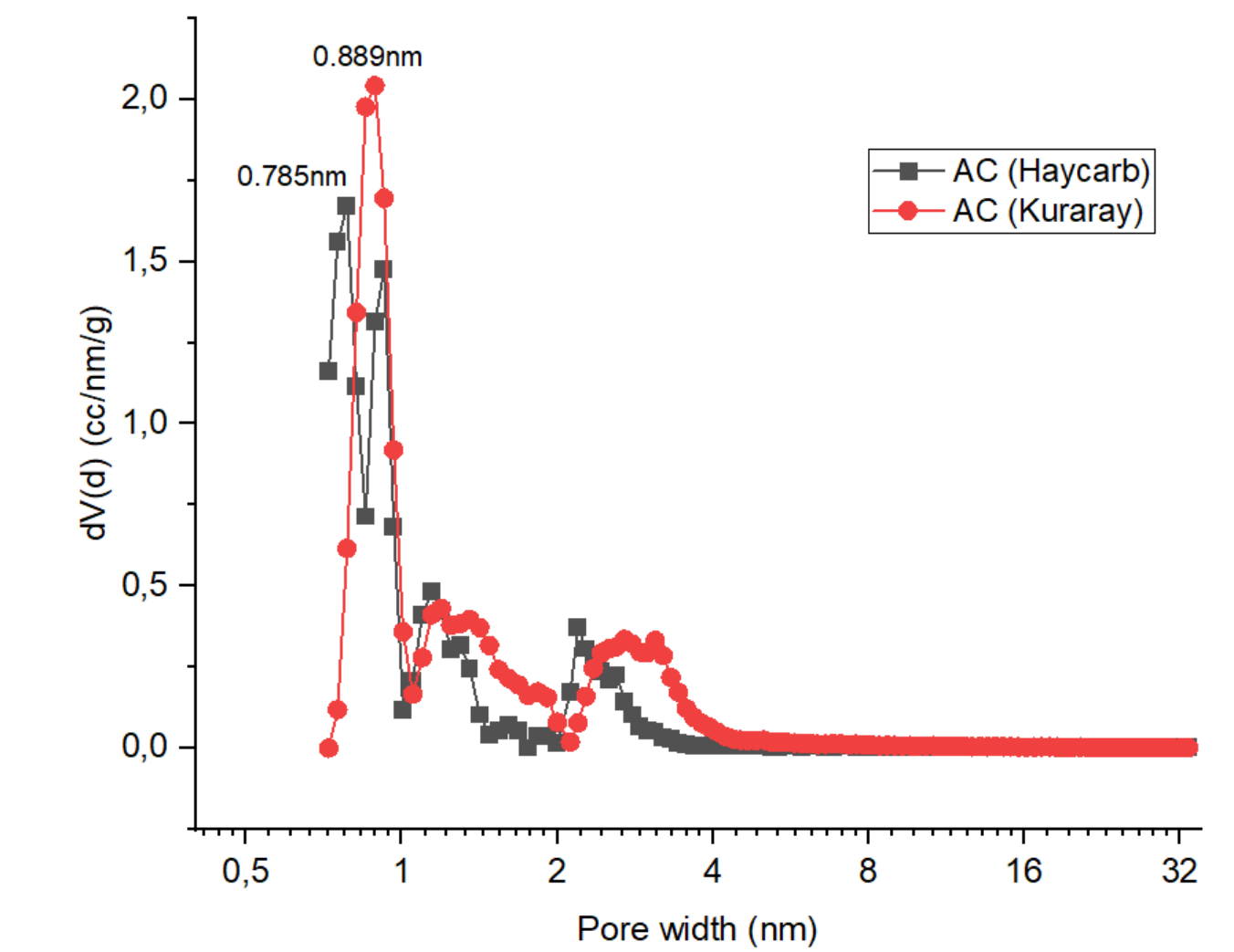


Cyclic voltammetry (CV) of C/S cathode

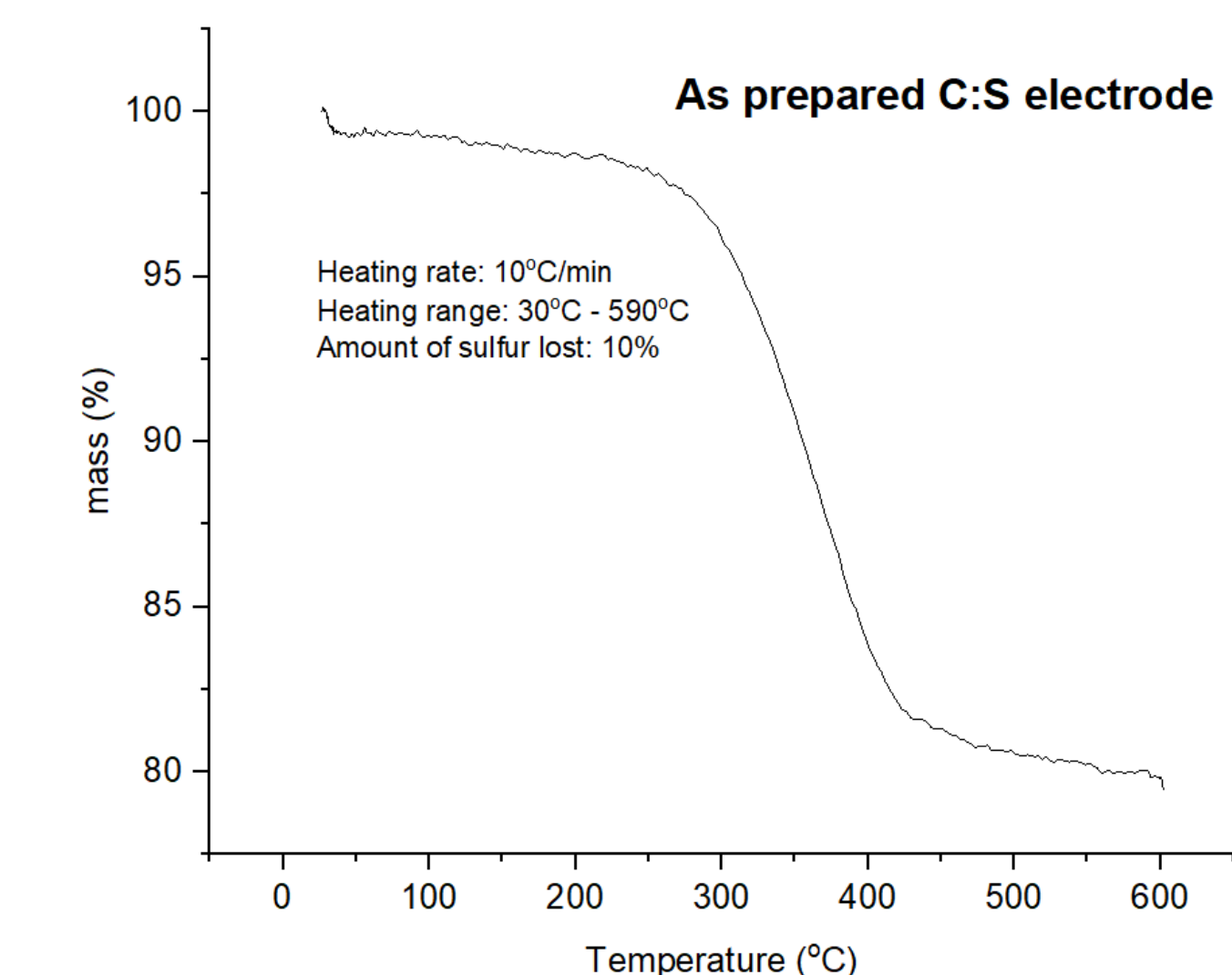


Download the poster

## Characterization

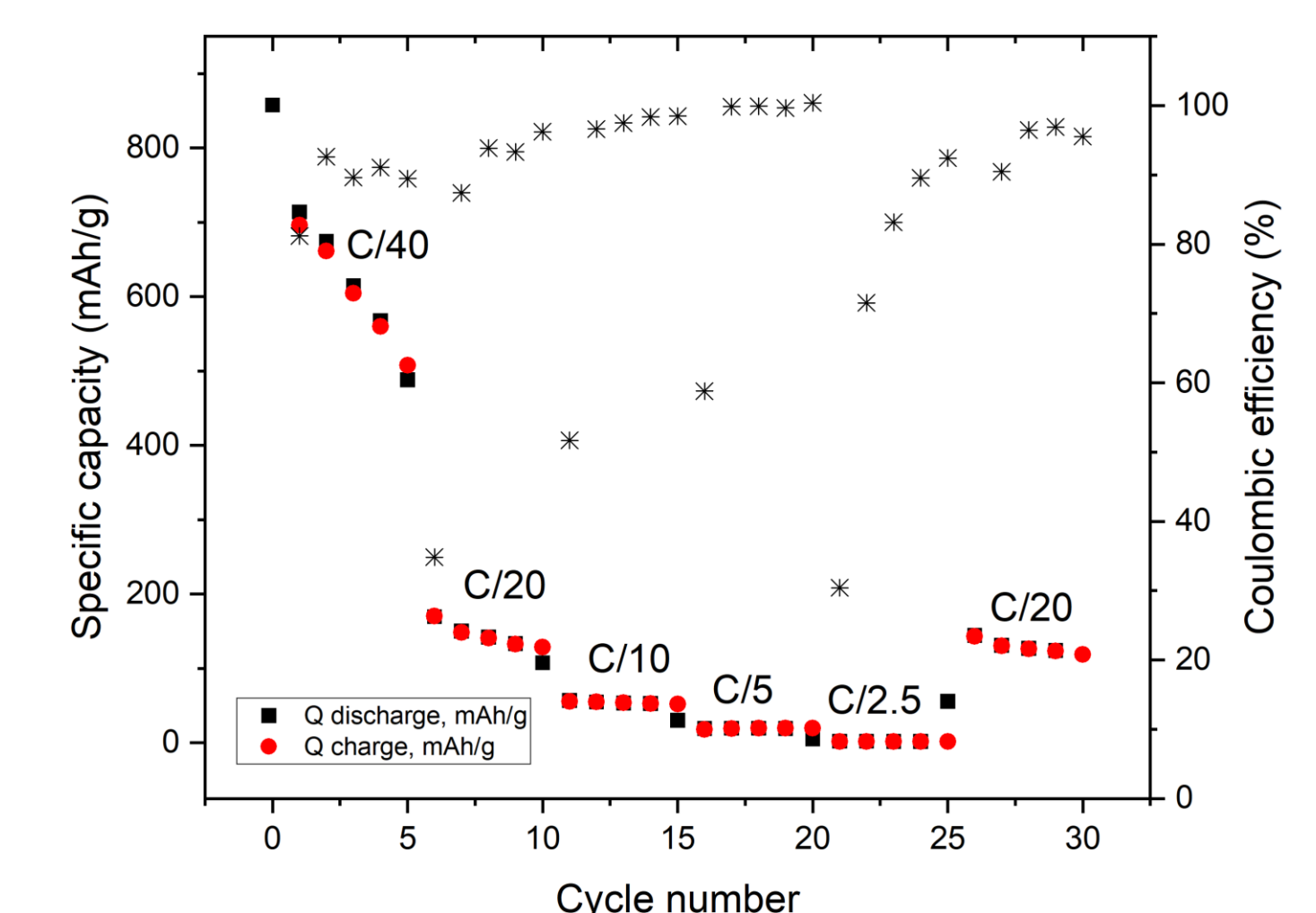


Pore size distribution of carbon samples via BET analysis

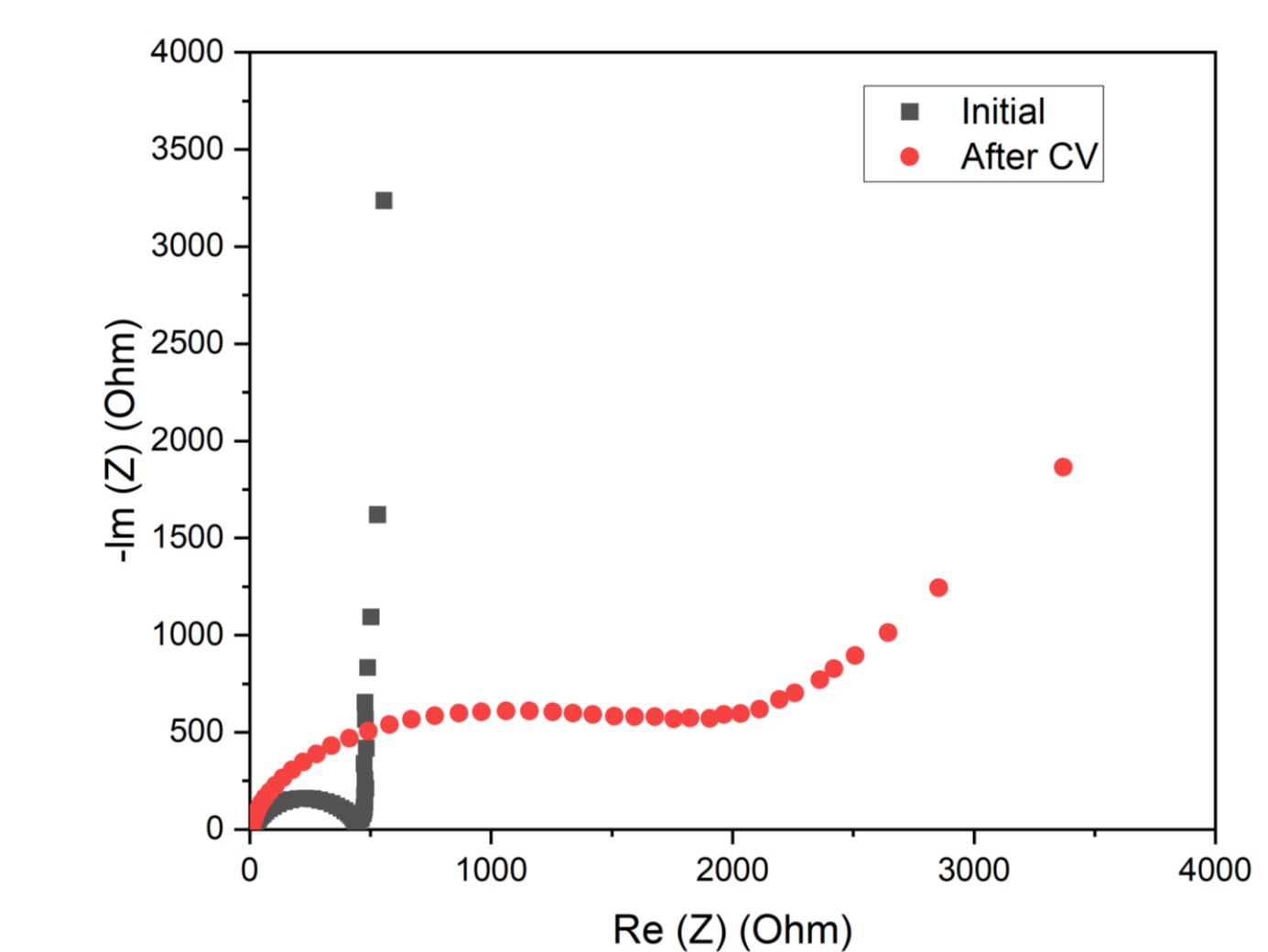


Thermogravimetric analysis of as prepared C/S electrode

## Cathode Performance



Rate capability of C/S cathode



EIS Nyquist plot of C/S cathode

## Acknowledgement

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