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High Performance Carbon Nanofiber Supercapacitor Electrode with Tuned Porous Structure

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A high-performance symmetrical supercapacitor device based on carbon nanofibres with optimized linear tube structure

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Topics

- Introduction
- Process background
- Characterization and properties
- Electrochemical properties
- Applications
- Summary
- References

Introduction

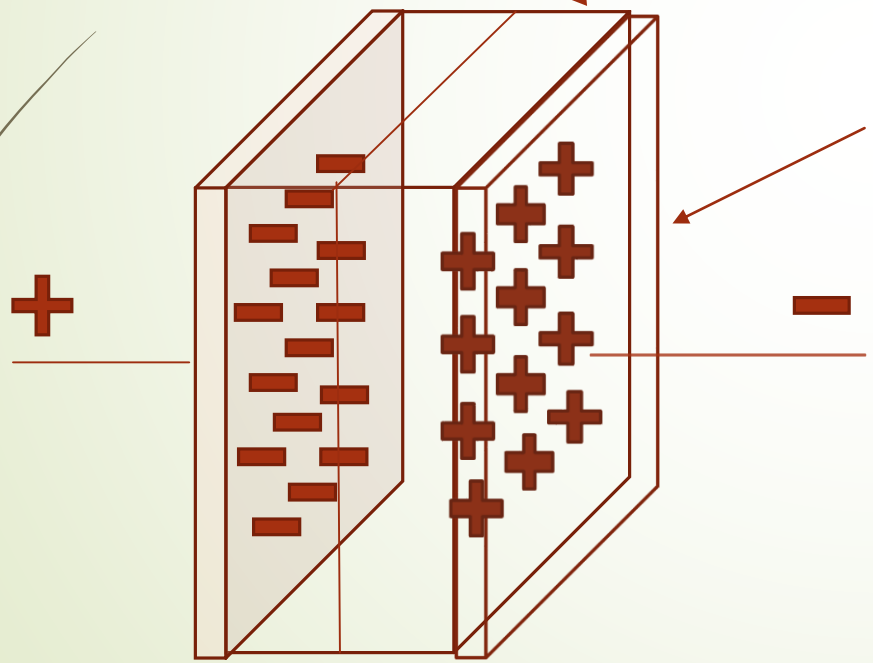
- Energy conservation and its use

Energy Production

Stored local energy

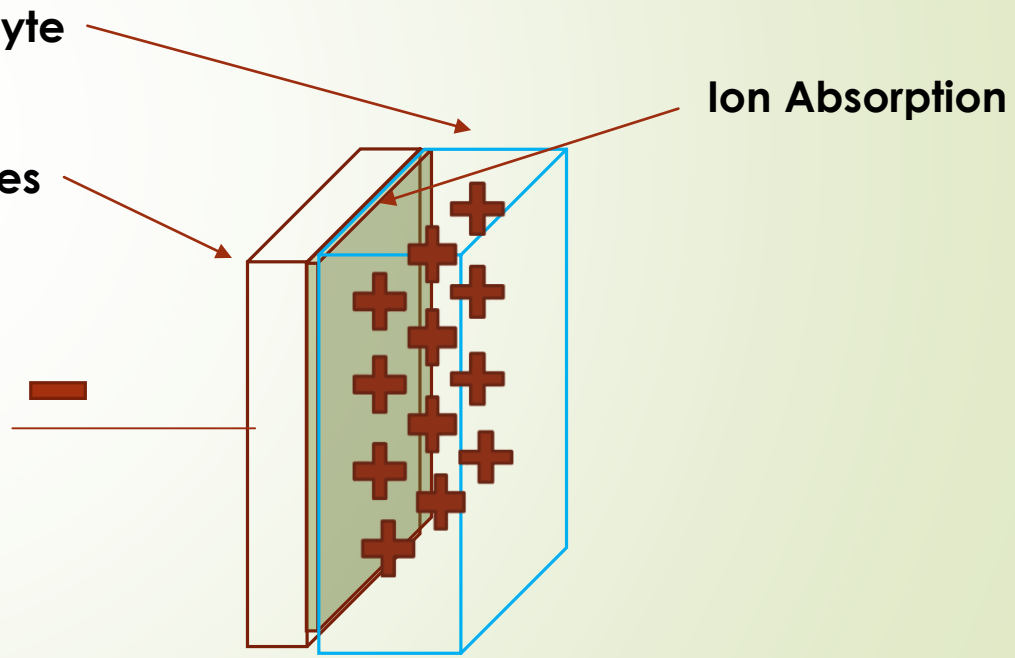
Supercapacitors

1) Electric Double Layer



EDL is 0.6-1 nm thick

2) Faradic Reaction



Charge Layer is nm to μm thick

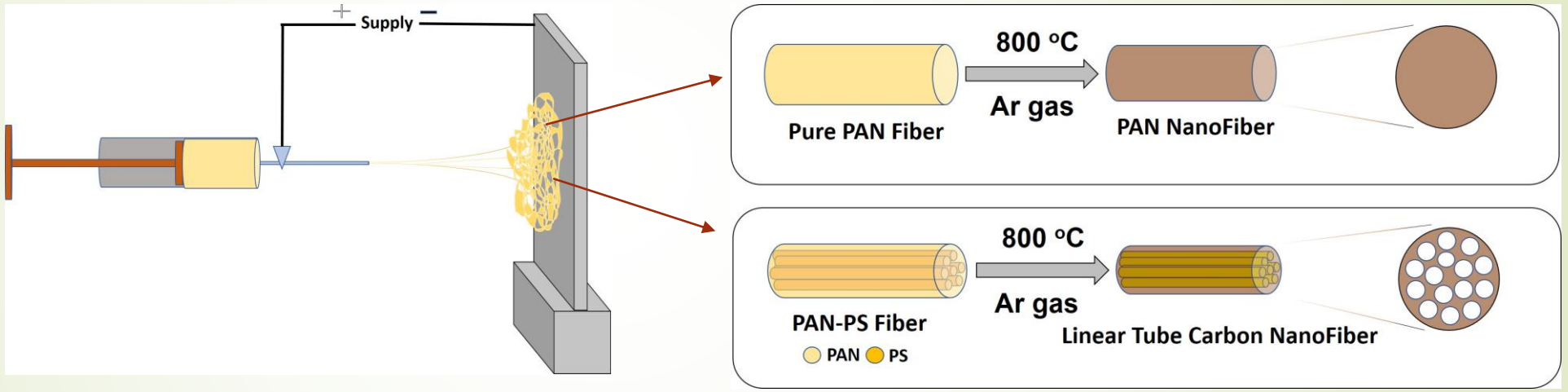
Overall Process

Step 1
- 10% PAN Solution in DMF
- 10% PAN-PS (1:1) in DMF

Step 2
- Electrospinning of the Fibers
- Carbonization at 800°C

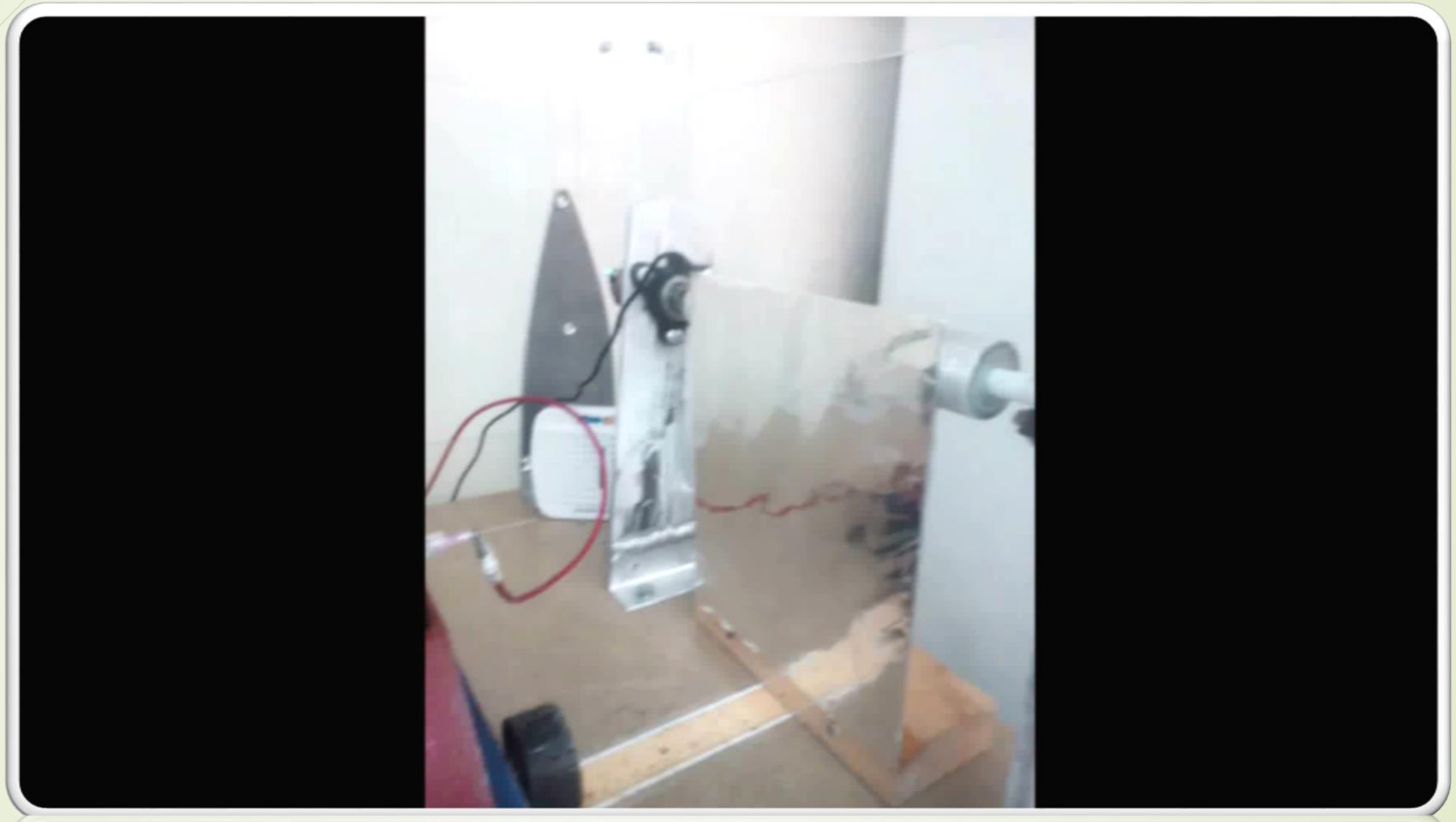
Step3
- Make an electrode by dip-coating Ni-Foam
- Electrochemical characterization

Electrospinning

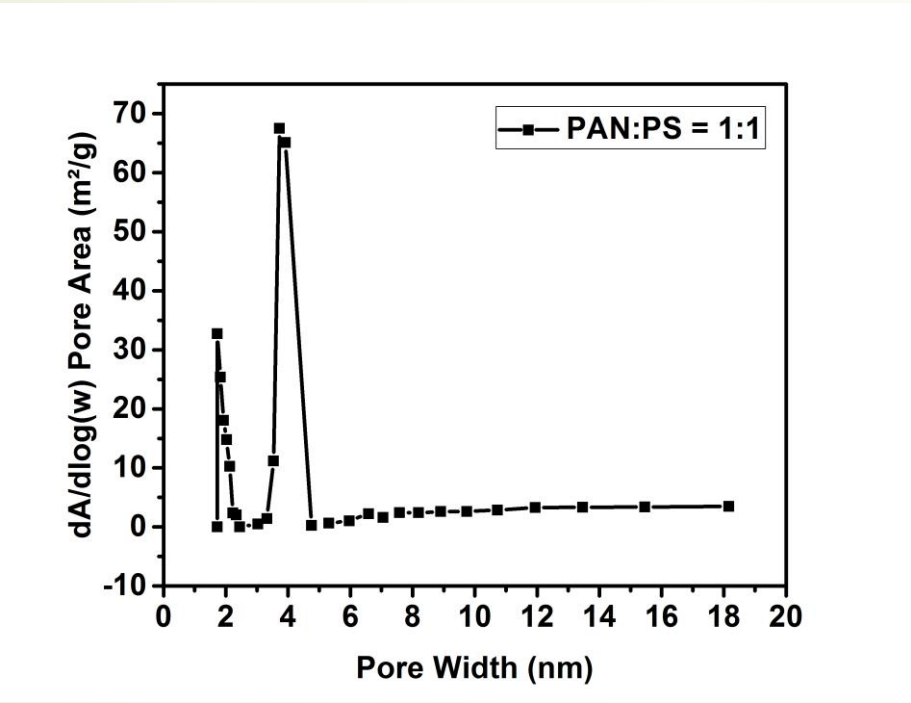


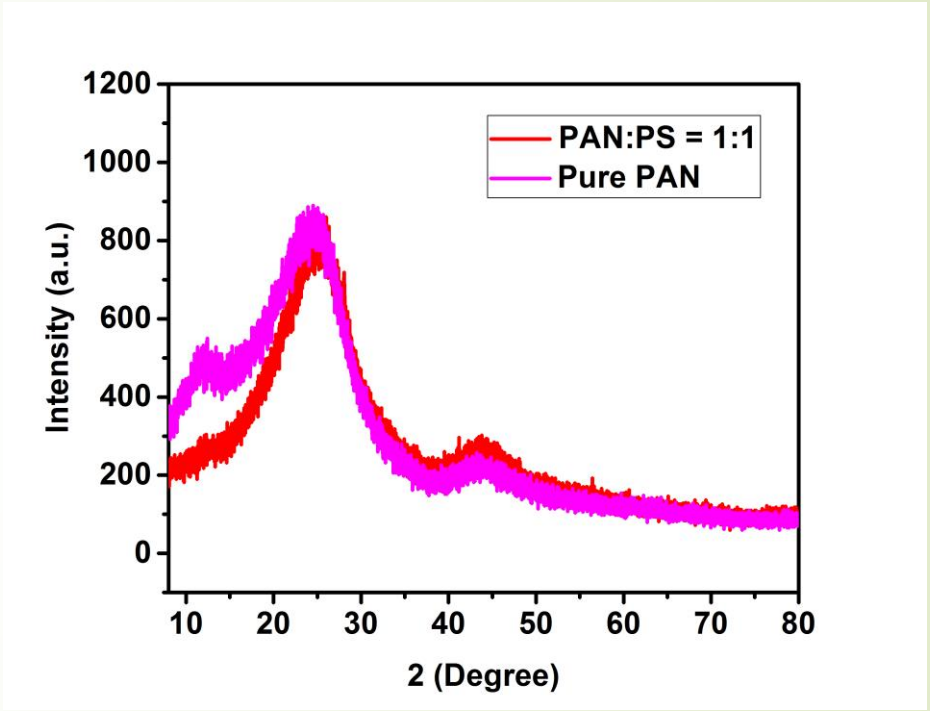
Linear Tube Carbon Nanofiber (LTCNF)

Electrospinning



Characterization of LTCNF

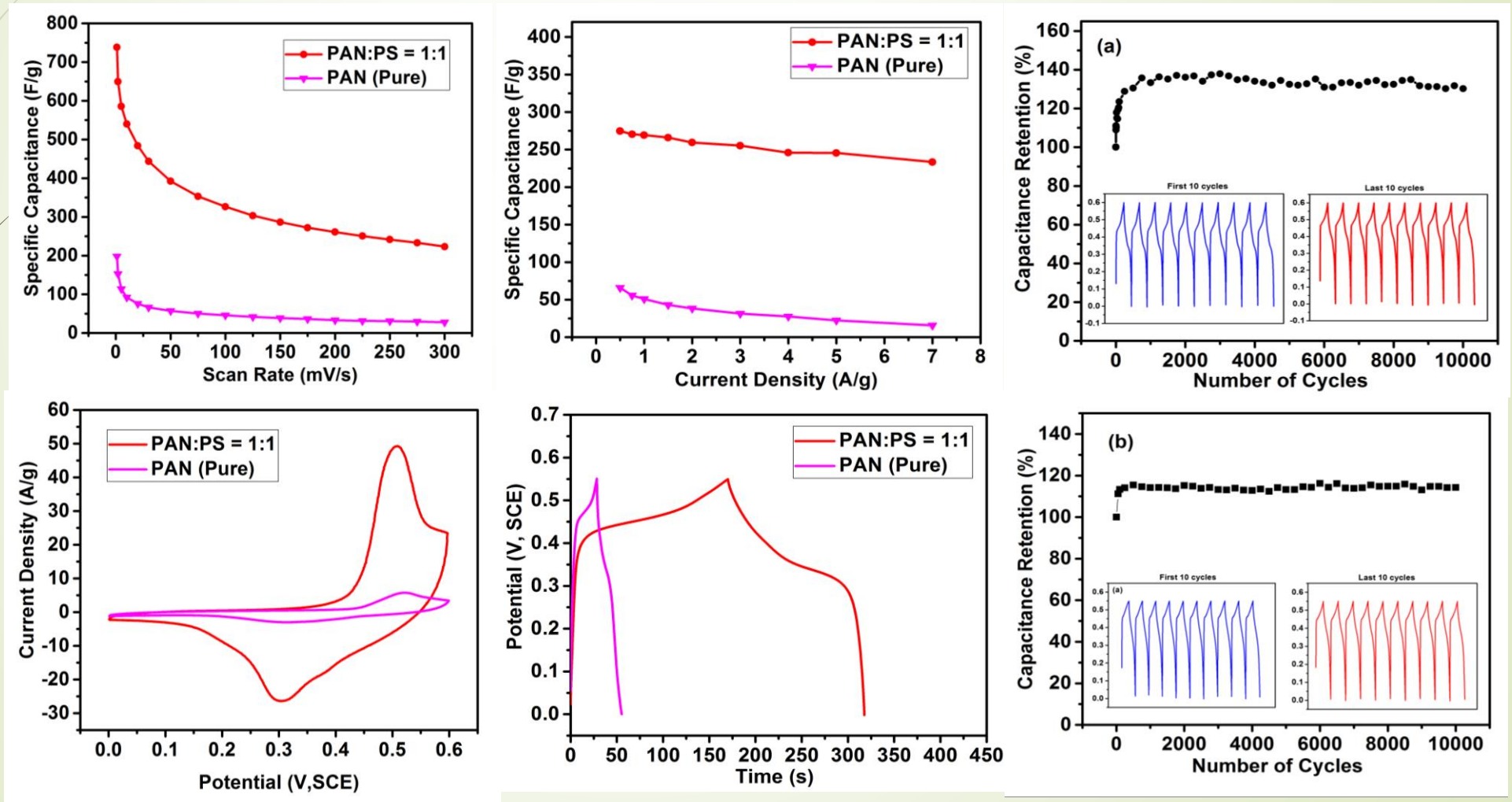




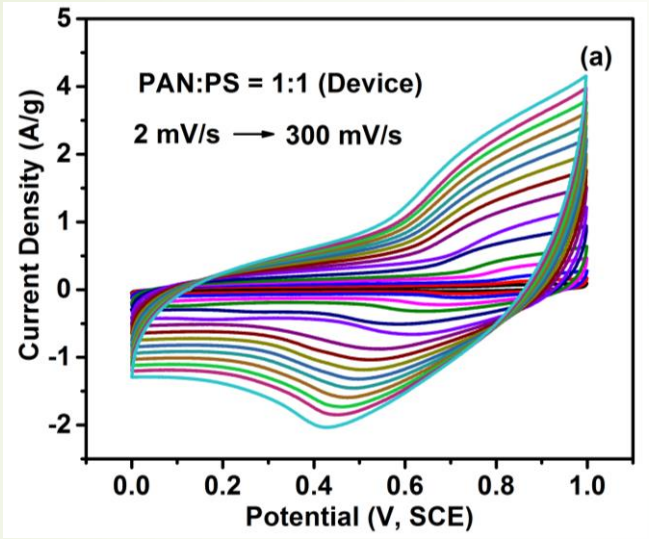
BET Surface area = ~86 m^2/gm

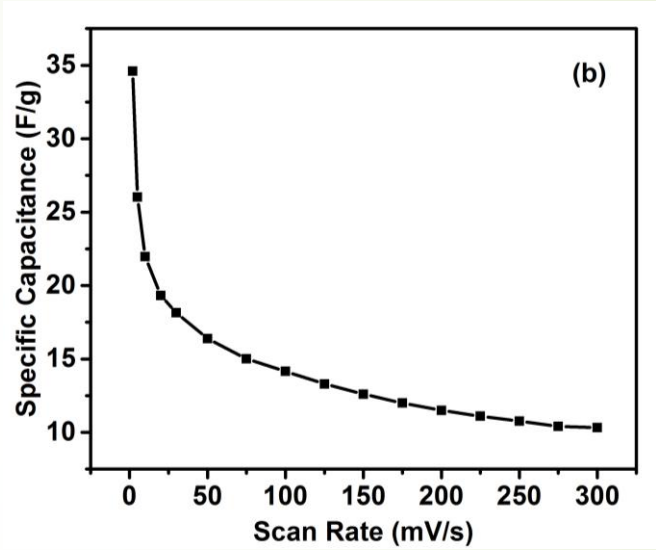
Electrochemical Measurements

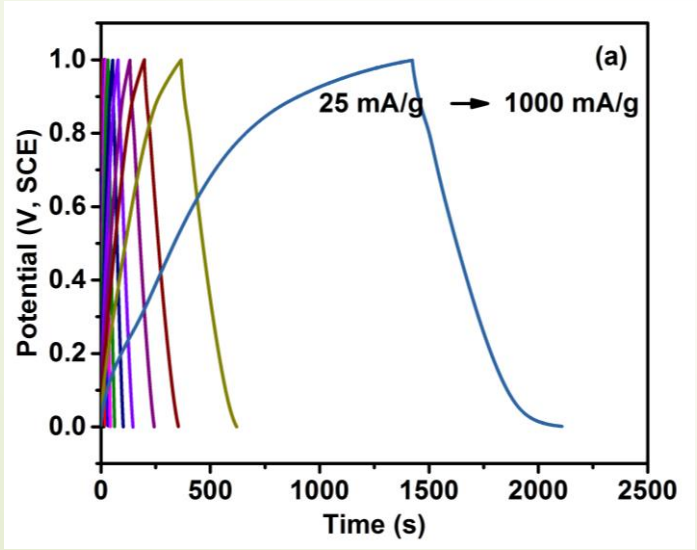
- CV and CD curves

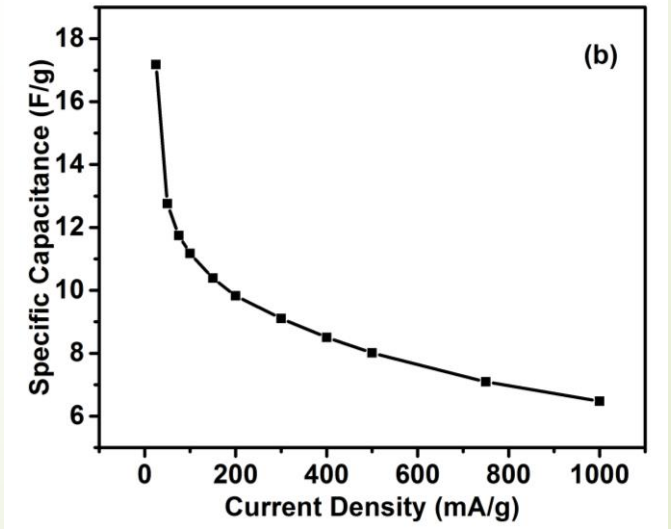


Device Study

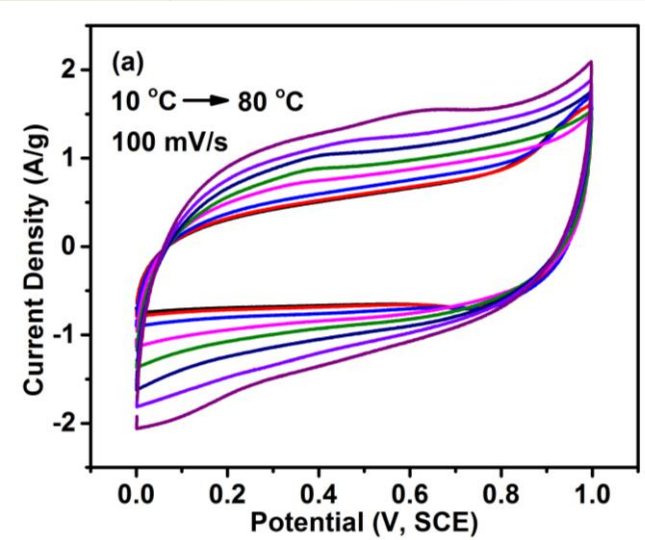


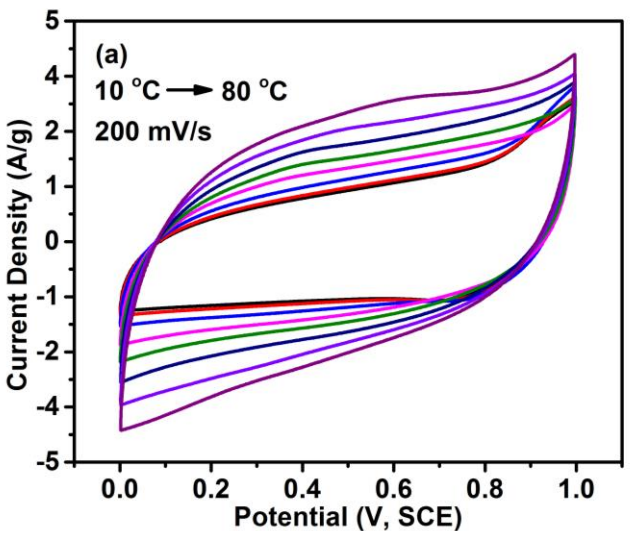


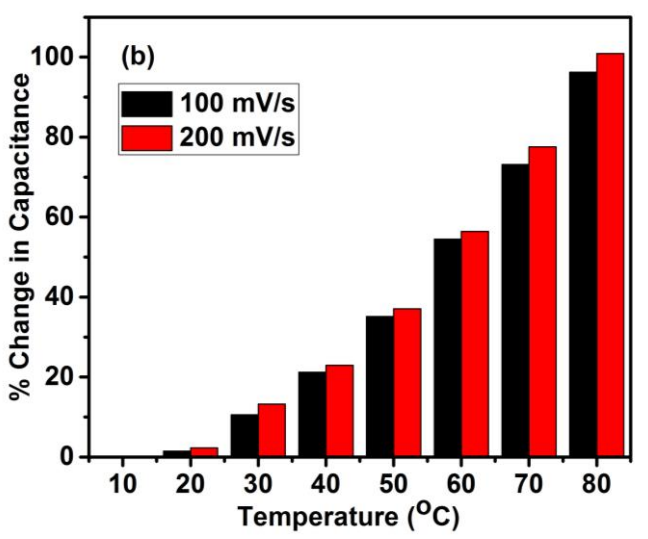


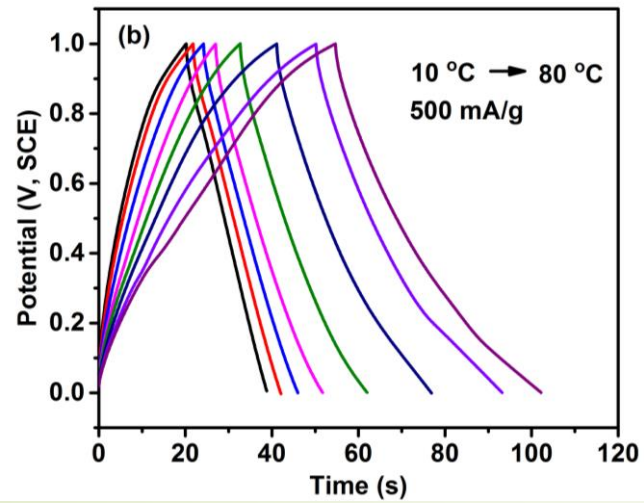


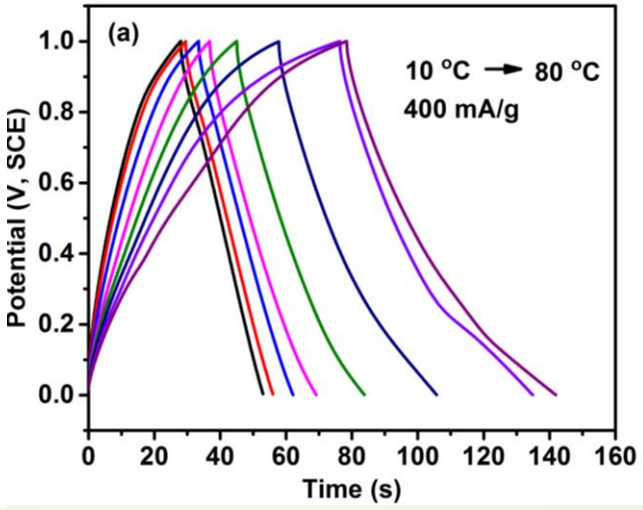
Device Study

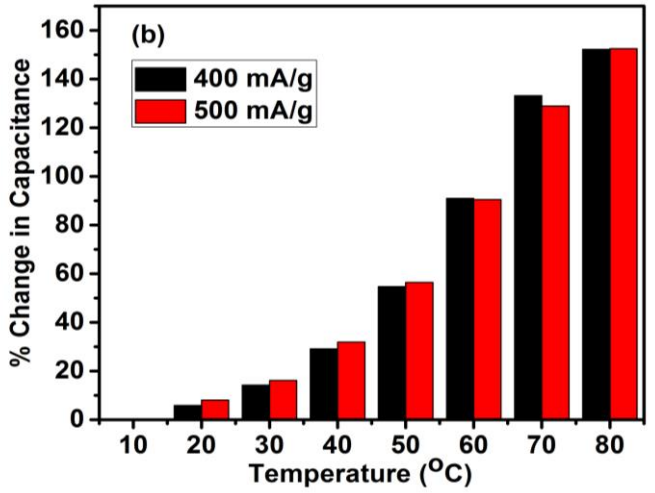




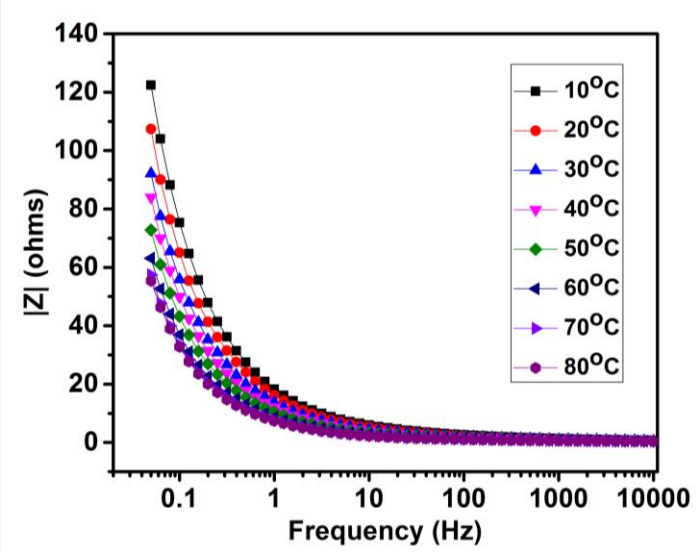


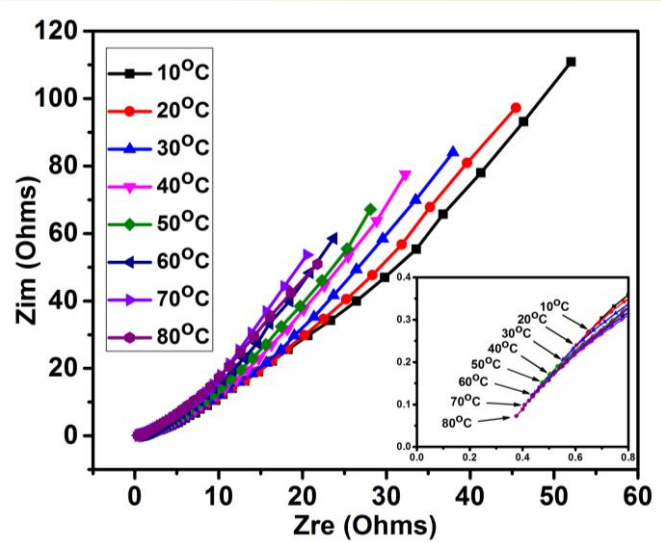


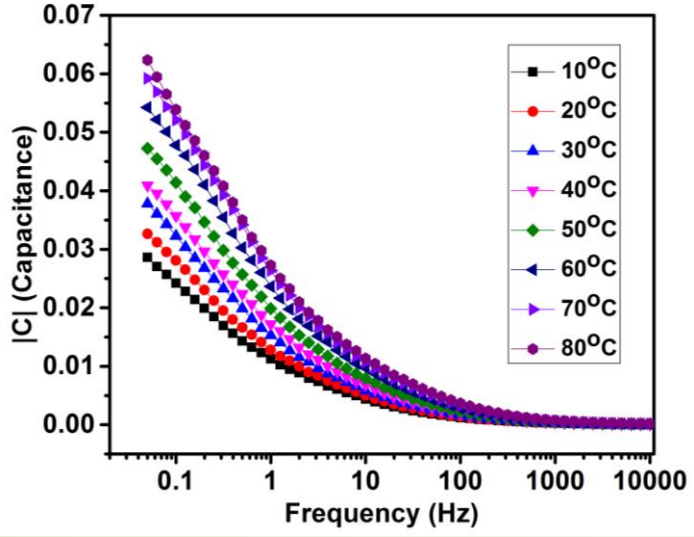


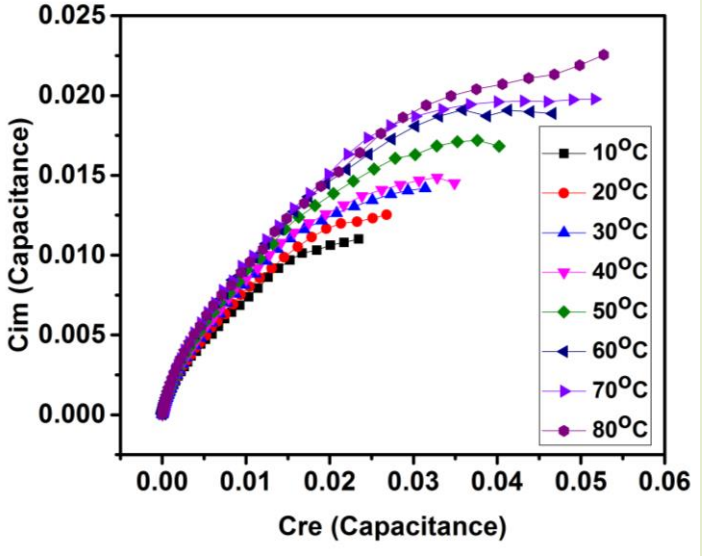


EIS for supercapacitor device









Applications of SC

Summary and future aspects for research

Future of Research

- Introduction
- How to prepare Carbon nanofibers by electrospinning
- Coating with various redox materials to obtain high performance effects.
- Electrochemical devices fabrications, etc.
- Doping with ions
- Electrochemical behaviour of materials for electrode in 3 electrode system
- Electrochemical measurements for SC device
- Effect of temperature on device
- EIS results
- Applications

References

1) Flexible solid-state electrochemical supercapacitors
   By- Peihua Yang, Wenjie Main
   Nano Energy(2014) 8, 274–290
2) Images from introduction and application slide are from Google images

Thank You