

Carbon Materials from DDGS for Supercapacitors and Properties Improvement by H₂O₂ Surface Modification

Hong Jin

South Dakota State University

Jun 14/2013

Outline

❖ Introduction

- ❑ Supercapacitors
- ❑ Carbon electrode materials

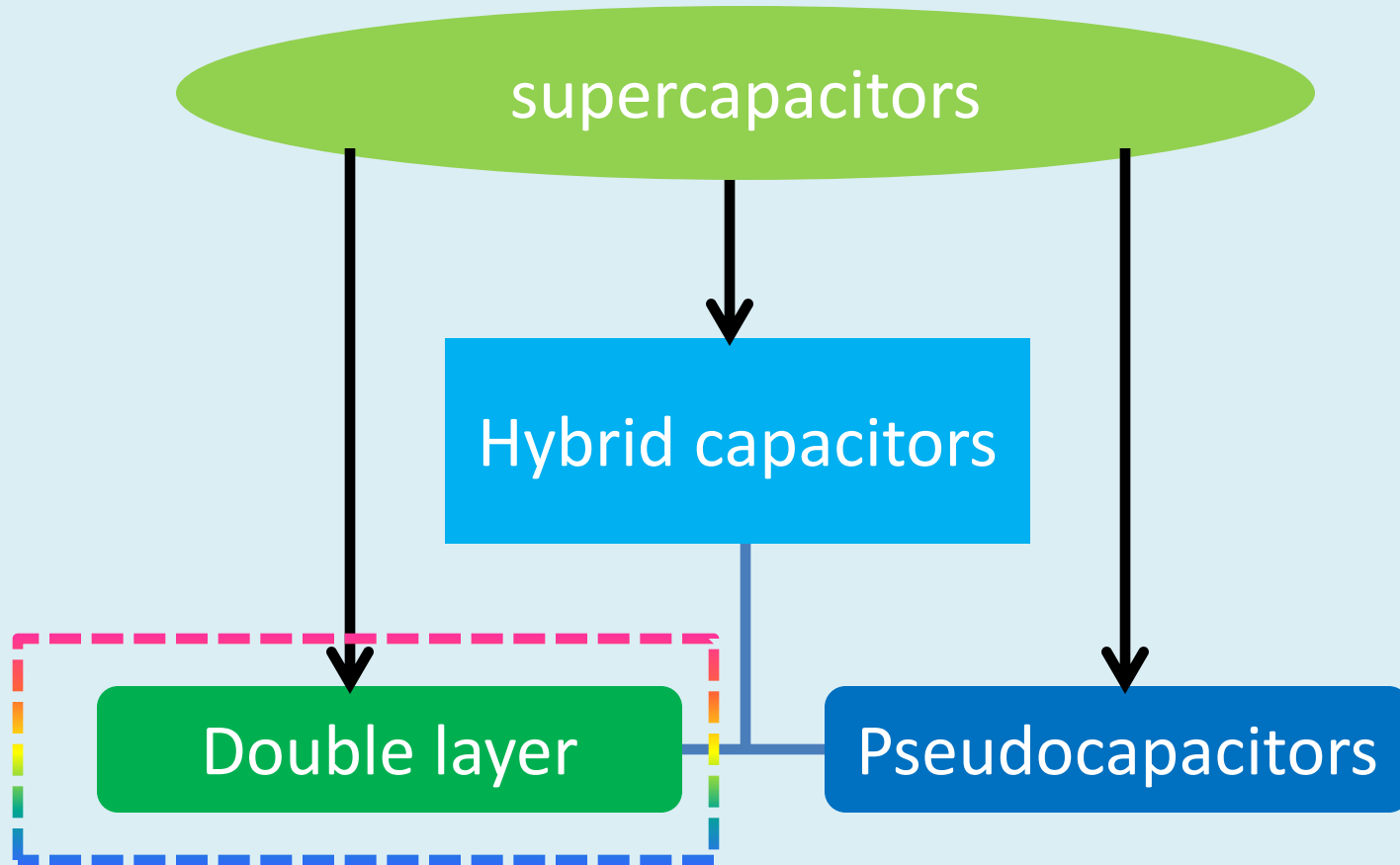
❖ Characterization

- ❑ Porous properties
- ❑ SEM
- ❑ Raman spectrum

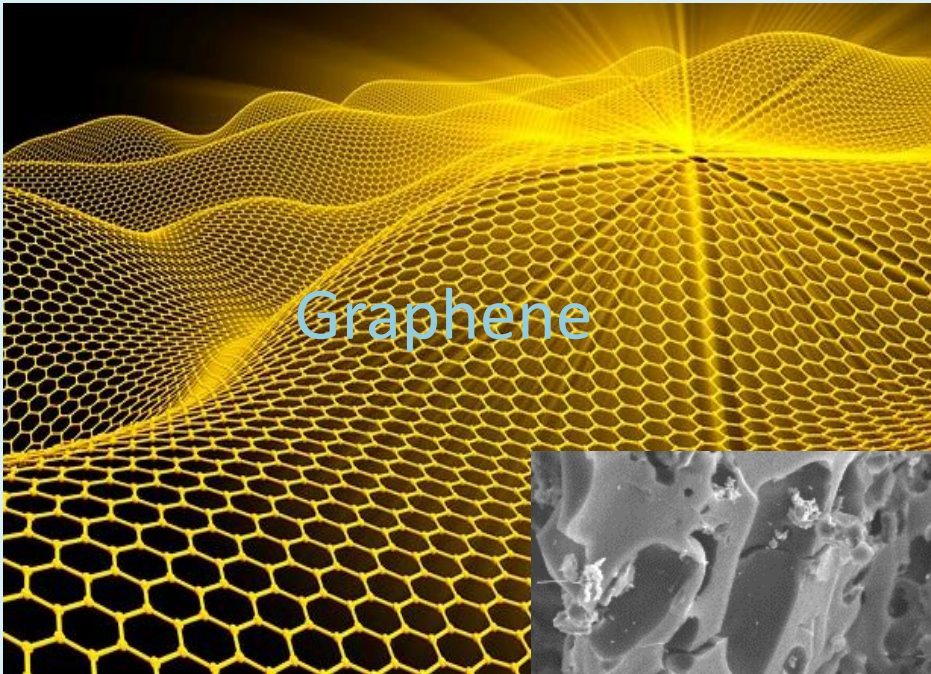
❖ Electrochemical properties

❖ Conclusion

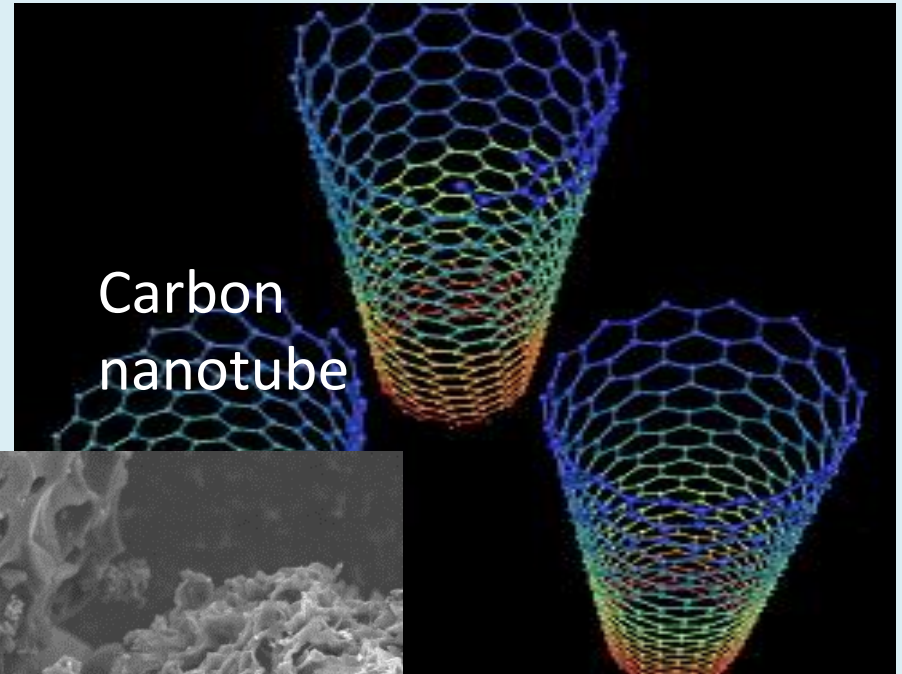
Introduction--supercapacitors



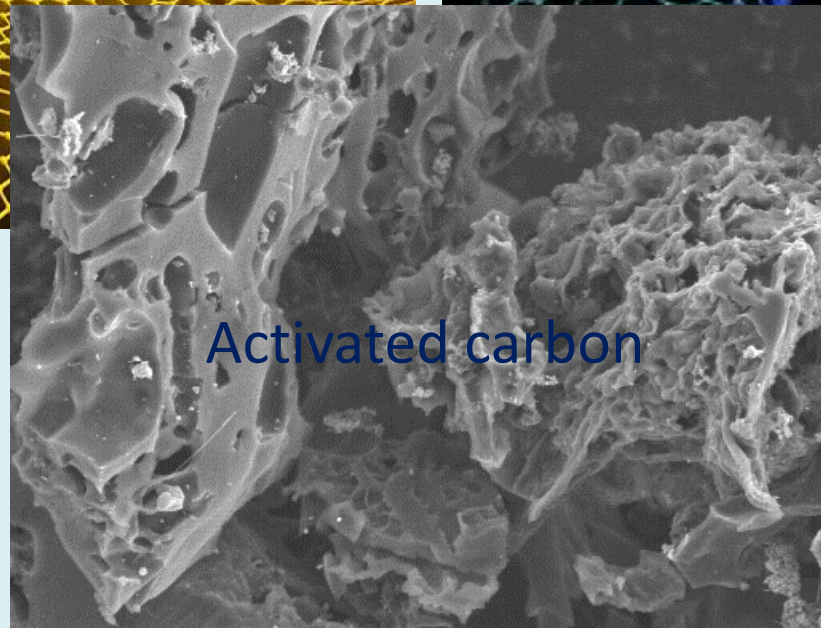
Introduction—carbon materials



Graphene

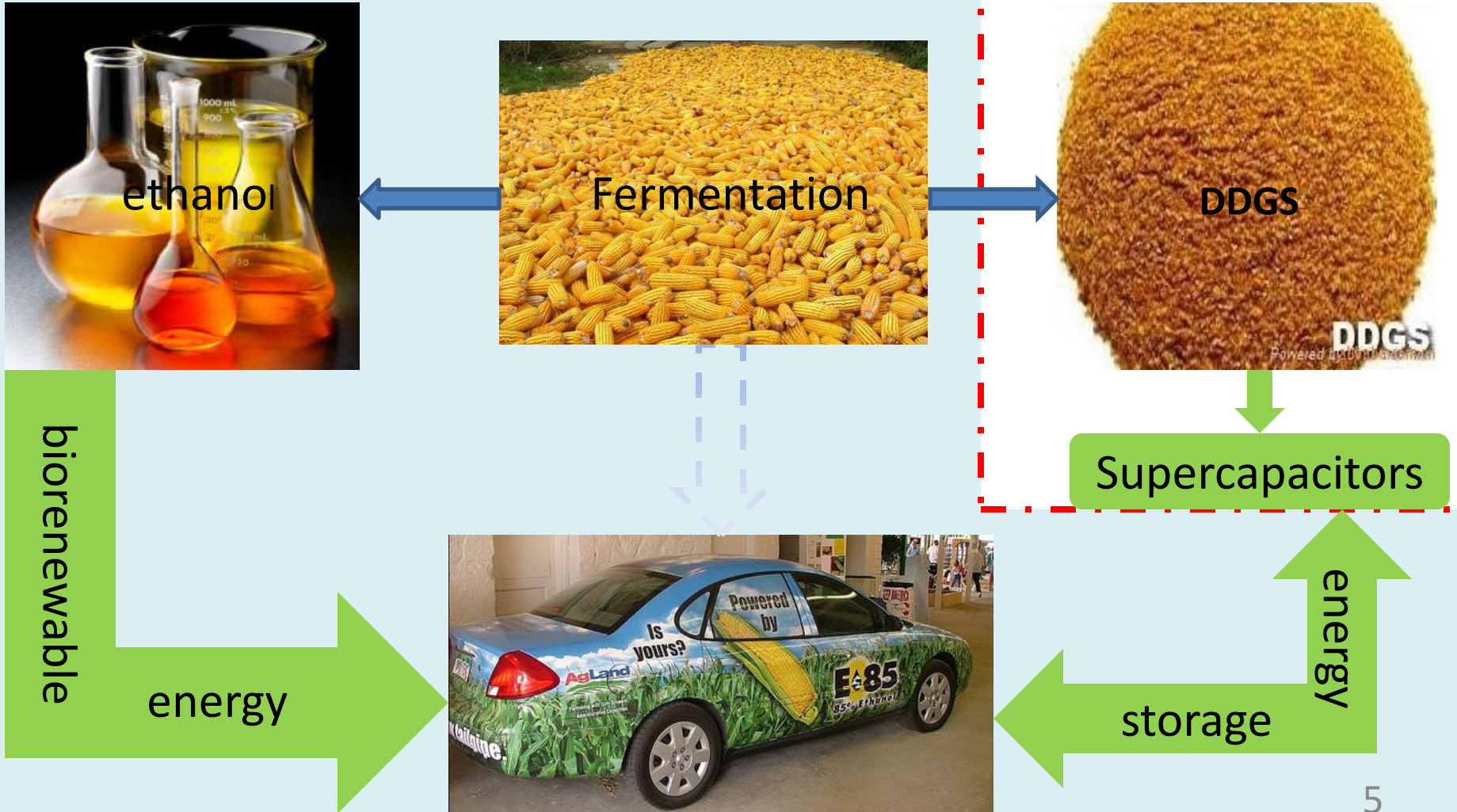


Carbon nanotube

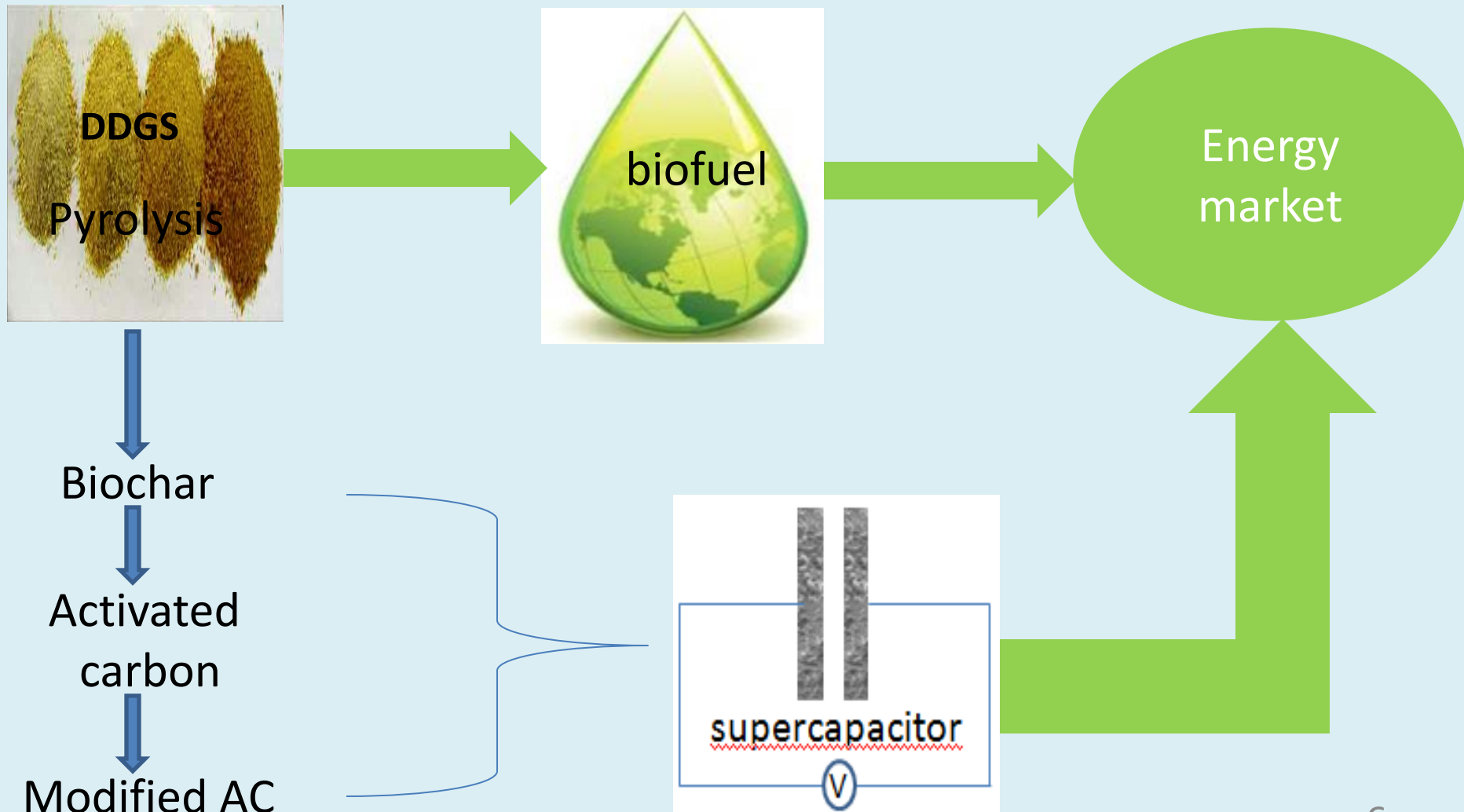


Activated carbon

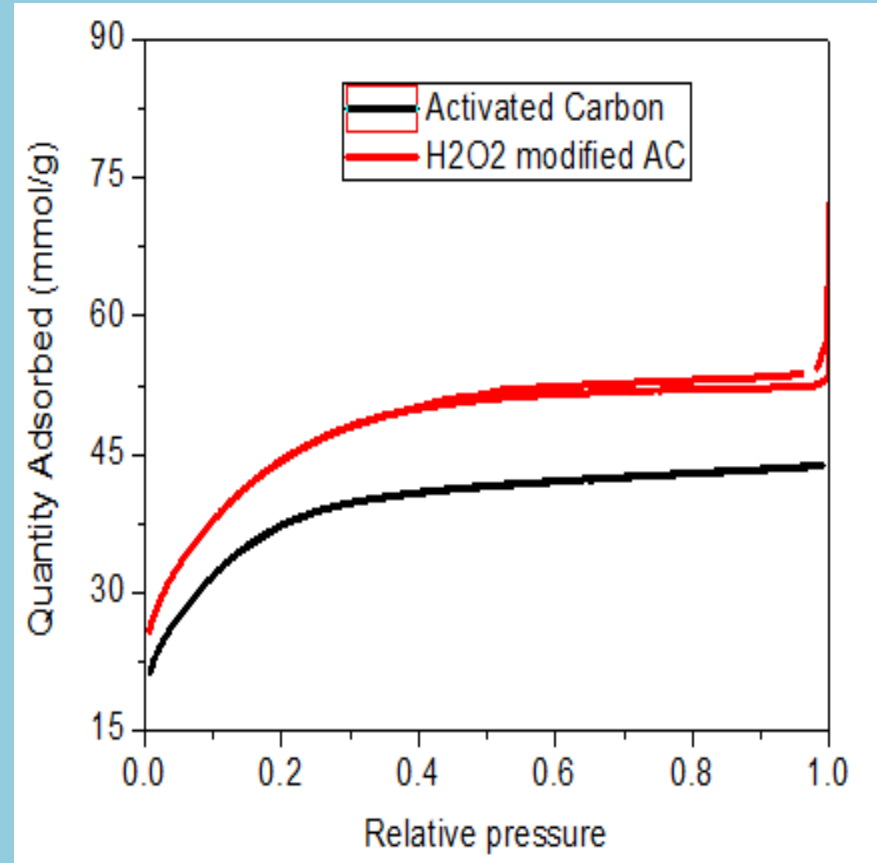
Introduction—carbon materials



Introduction—carbon materials



Characterization--BET



Characterization--BET

Sample	$S_{\text{BET}}^{\text{a}}$ (m^2 / g)	V_{t}^{b} (m^3 / g)	$V_{\text{micro}}^{\text{c}}$ (m^3 / g)	$V_{\text{meso}}^{\text{d}}$ (m^3 / g)
Biochar	19	0.0023		
Activated Carbon	2959	1.65	0.83	0.42
H ₂ O ₂ Modified AC	3396	1.84	1.18	0.65

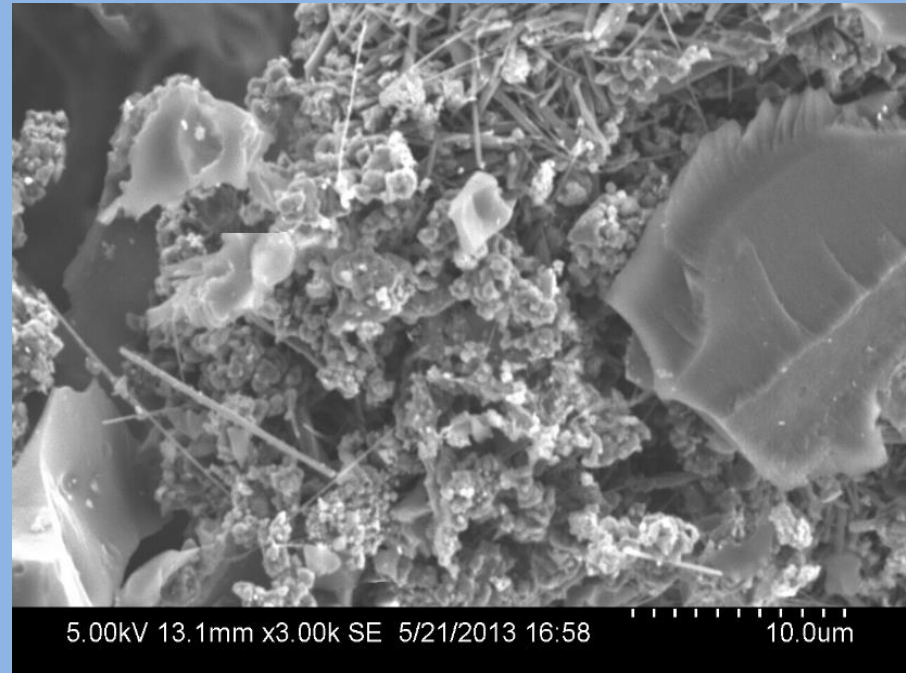
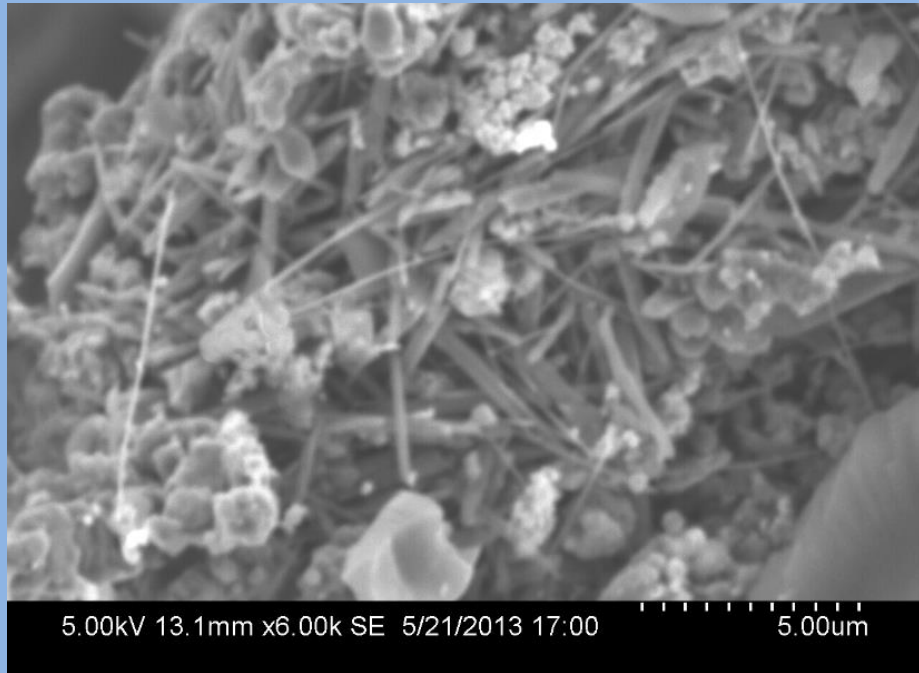
^a BET (Brunauer-Emmett-Teller) surface area.

^b Total pore volume, derived from NLDFT model.

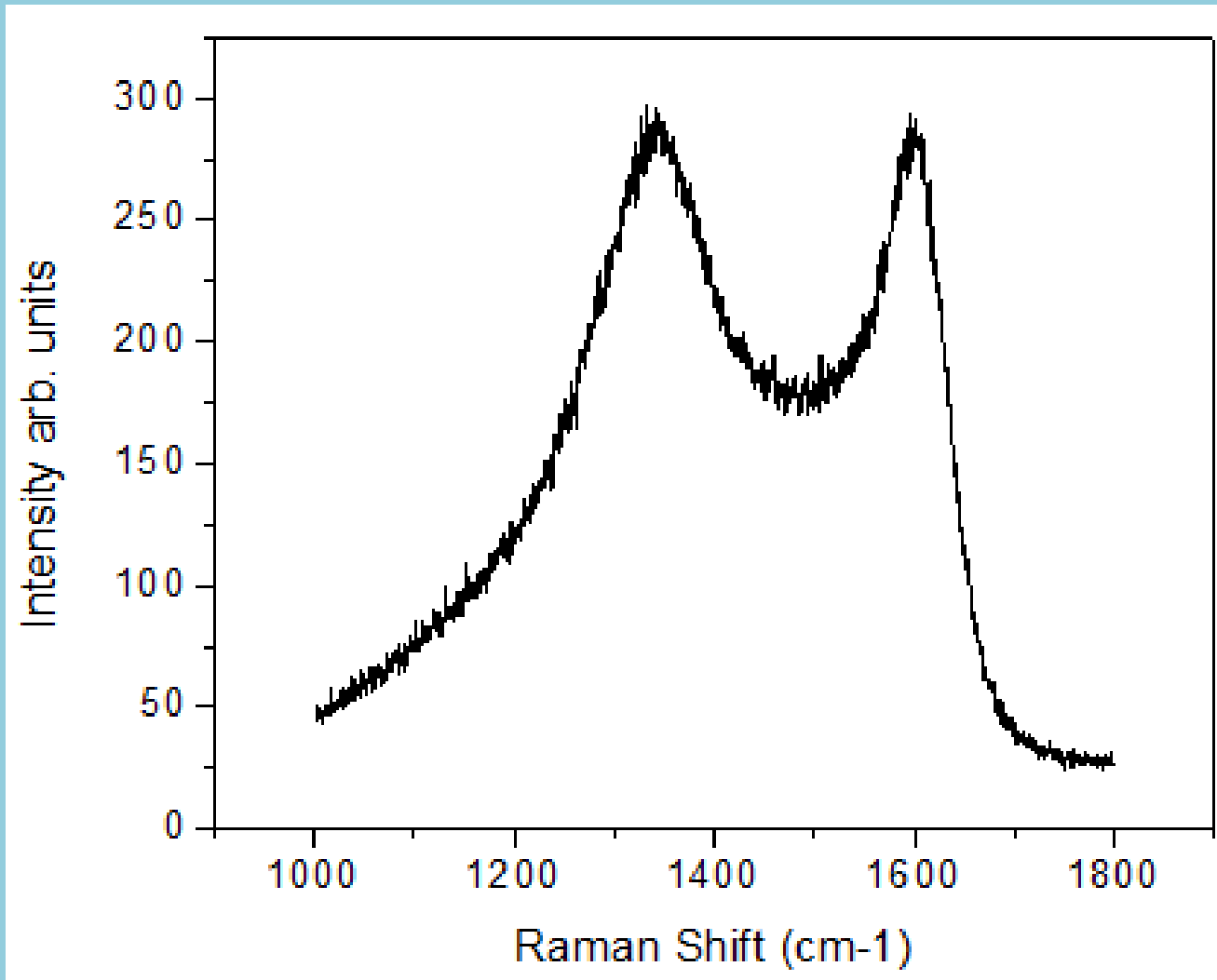
^c Micropore volume, derived from NLDFT model.

^d Mesopore volume, derived from NLDFT model.

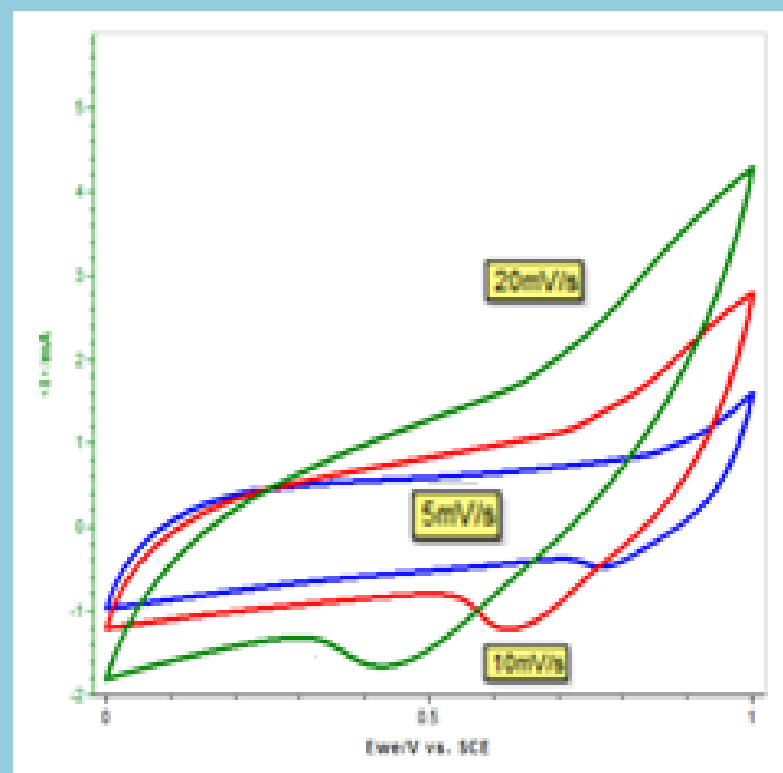
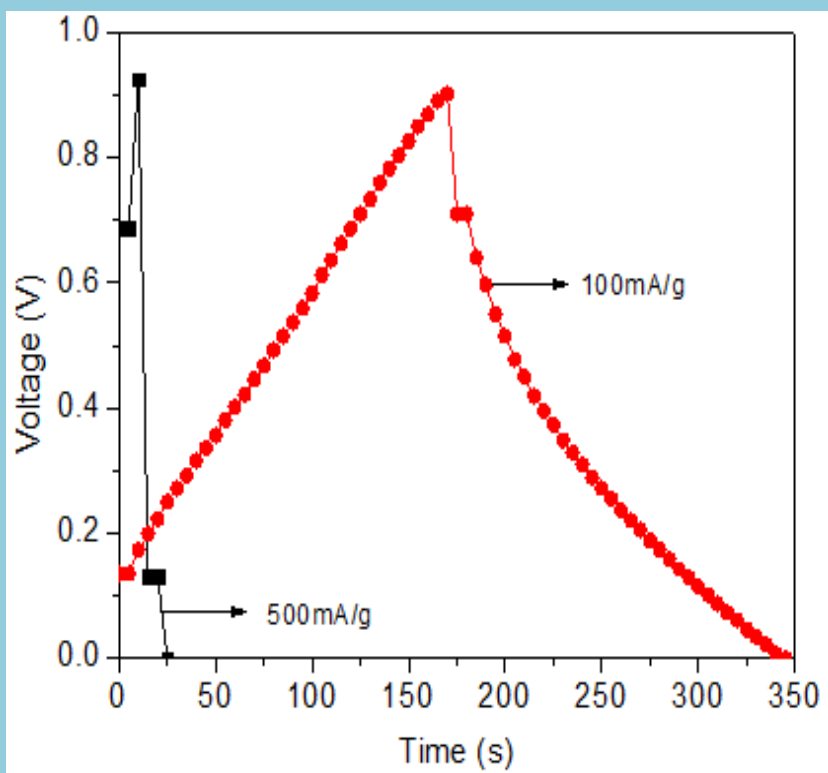
Characterization—SEM



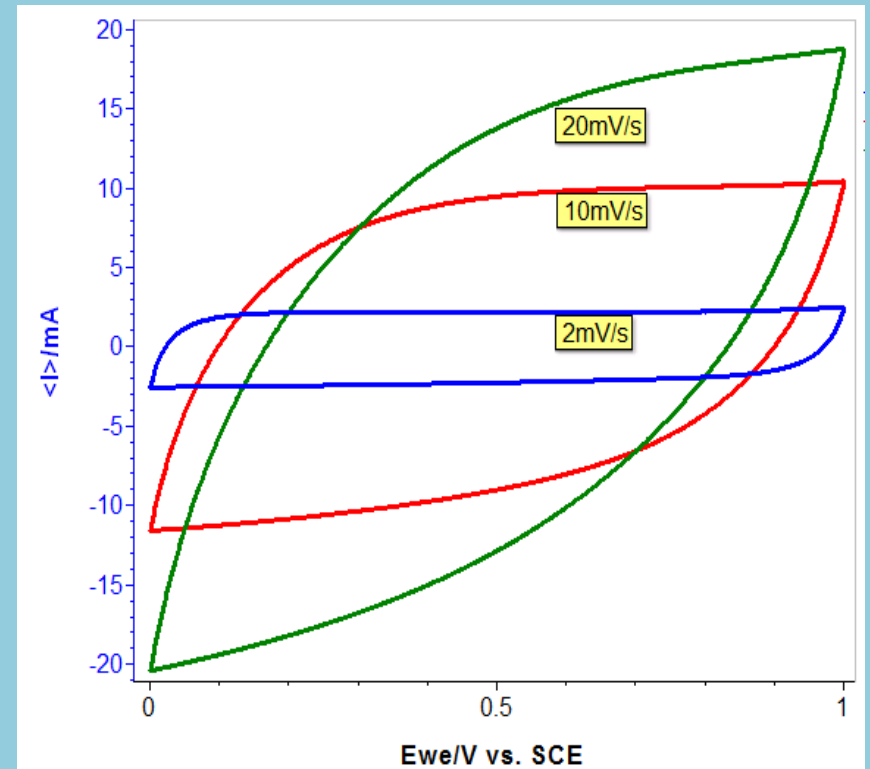
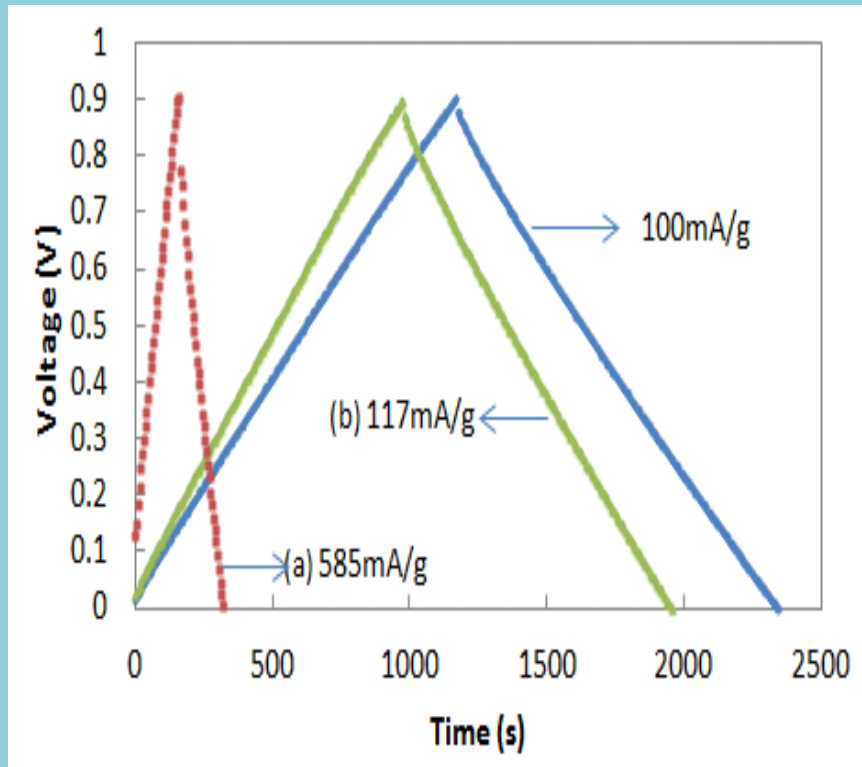
Characterization—Raman



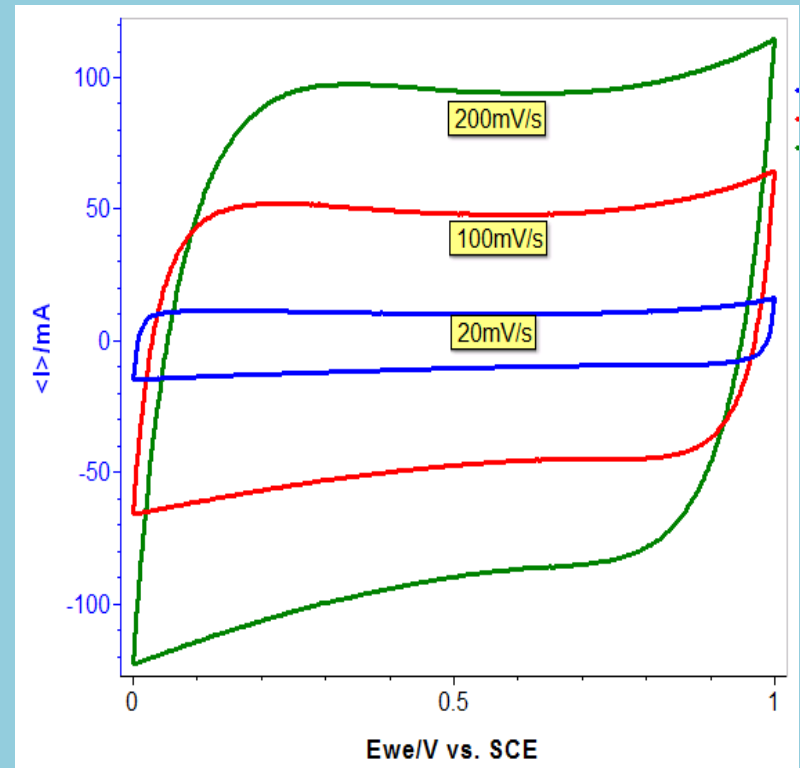
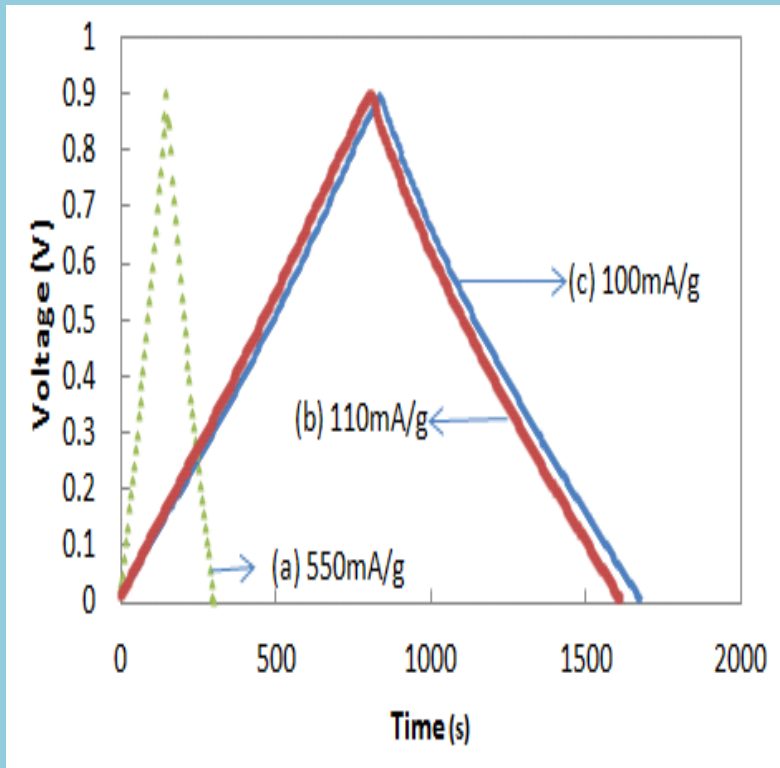
Electrochemical--Biochar



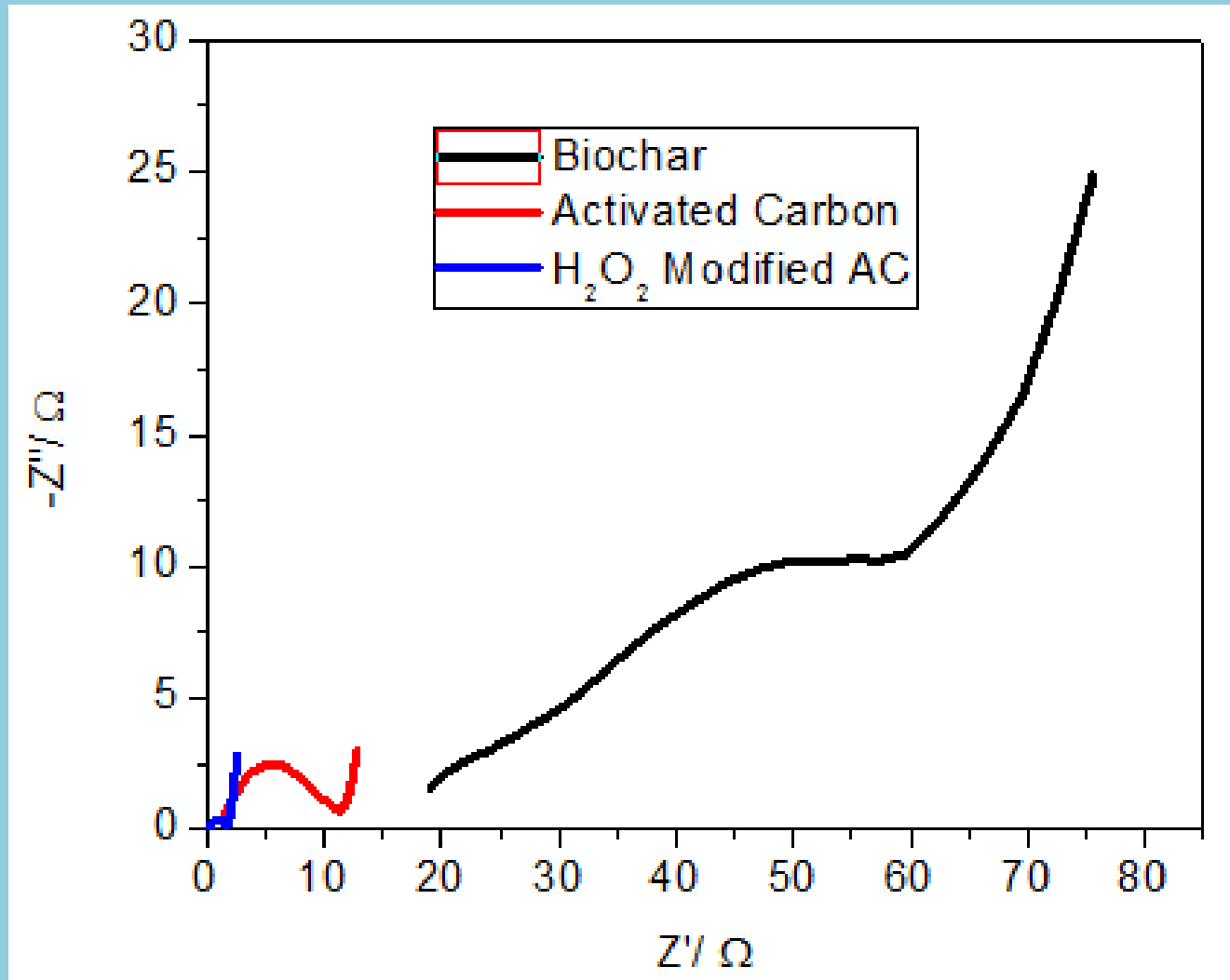
Electrochemical--AC



Electrochemical—H₂O₂ Modified AC



Electrochemical-EIS



Conclusion

- The biochar does not show good properties
- The activated carbon presents high specific capacitance
- The hydrogen peroxide modified carbon shows higher surface area
- The modified carbon demonstrates best cyclic voltammetry property and lowest inner resistance

Acknowledgements



Thank you

