

## Supplementary Information

### **Advancing Mesoporous Carbon Synthesis for Supercapacitors: A Systematic Investigation of Cross-linking Agent Effects on Pore Structure and Functionality**

**Yaoguang Song,<sup>a</sup> Xiaolei Zhang,<sup>\*b</sup> Peter A. A. Klusener,<sup>c</sup> and Peter Nockemann<sup>\*a</sup>**

<sup>a</sup>The QUILL Research Centre, School of Chemistry and Chemical Engineering, Queen's University Belfast, BT9 5AG, Belfast, UK. Email: [p.nockemann@qub.ac.uk](mailto:p.nockemann@qub.ac.uk)

<sup>b</sup>Department of Chemical and Process Engineering, University of Strathclyde, G1 1XJ, Glasgow, UK. Email: [xiaolei.zhang@strath.ac.uk](mailto:xiaolei.zhang@strath.ac.uk)

<sup>c</sup>Shell Global Solutions International B.V., Energy Transition Campus Amsterdam, Grasweg 31, 1031 HW Amsterdam, The Netherlands

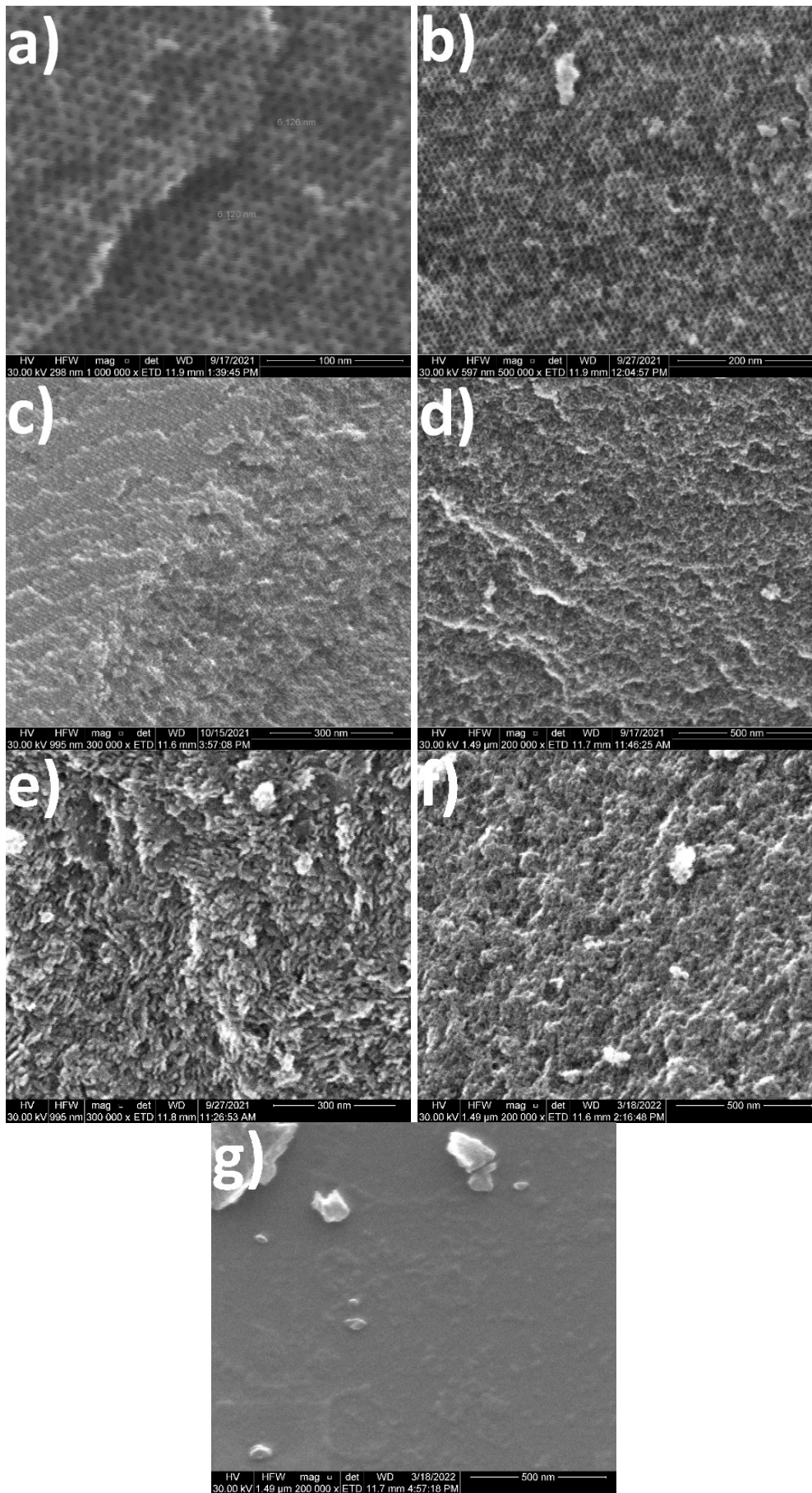
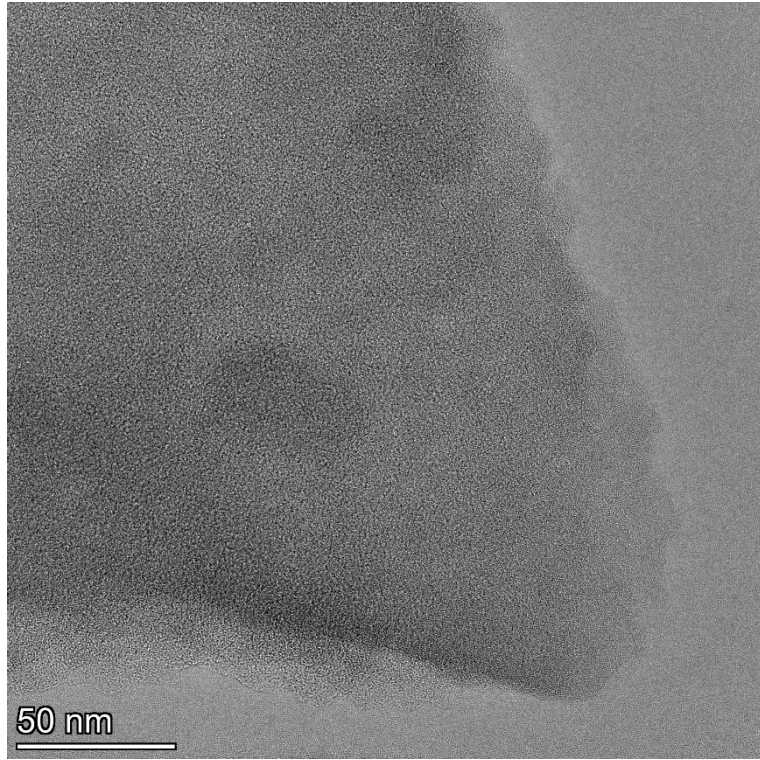


Figure S1. SEM images of all resulting MC samples: a-g) G1, G1.5, G2, F2, GA1, GA1.125, and GA1.25 in sequence.



*Figure S2. TEM image for sample GA1.25.*

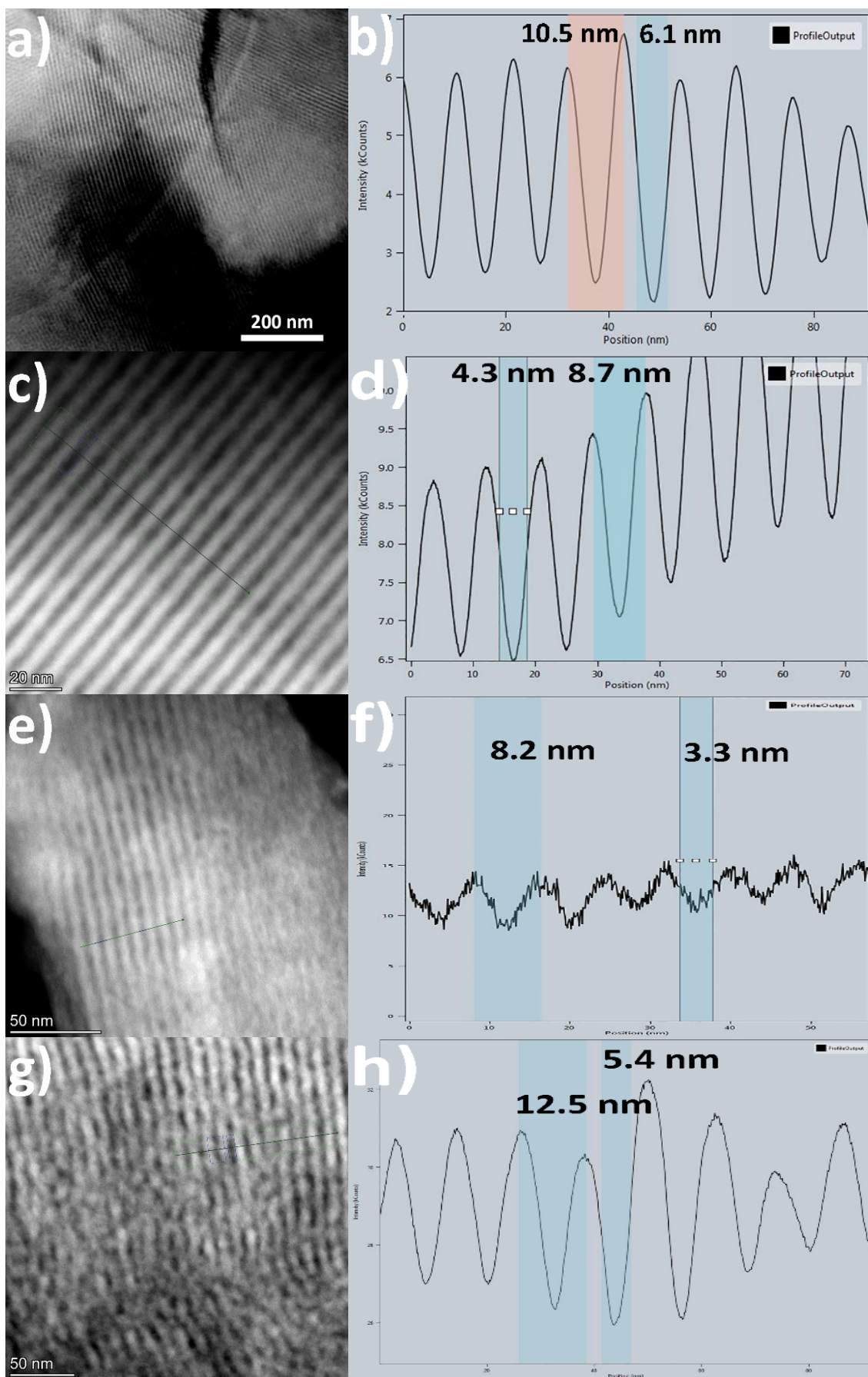


Figure S3 HAADF STEM images and line profile of processed HAADF intensity for ordered mesoporous samples: a, b) G1, c, d) G1.5, e, f) G2, and g, h) GAl, respectively.

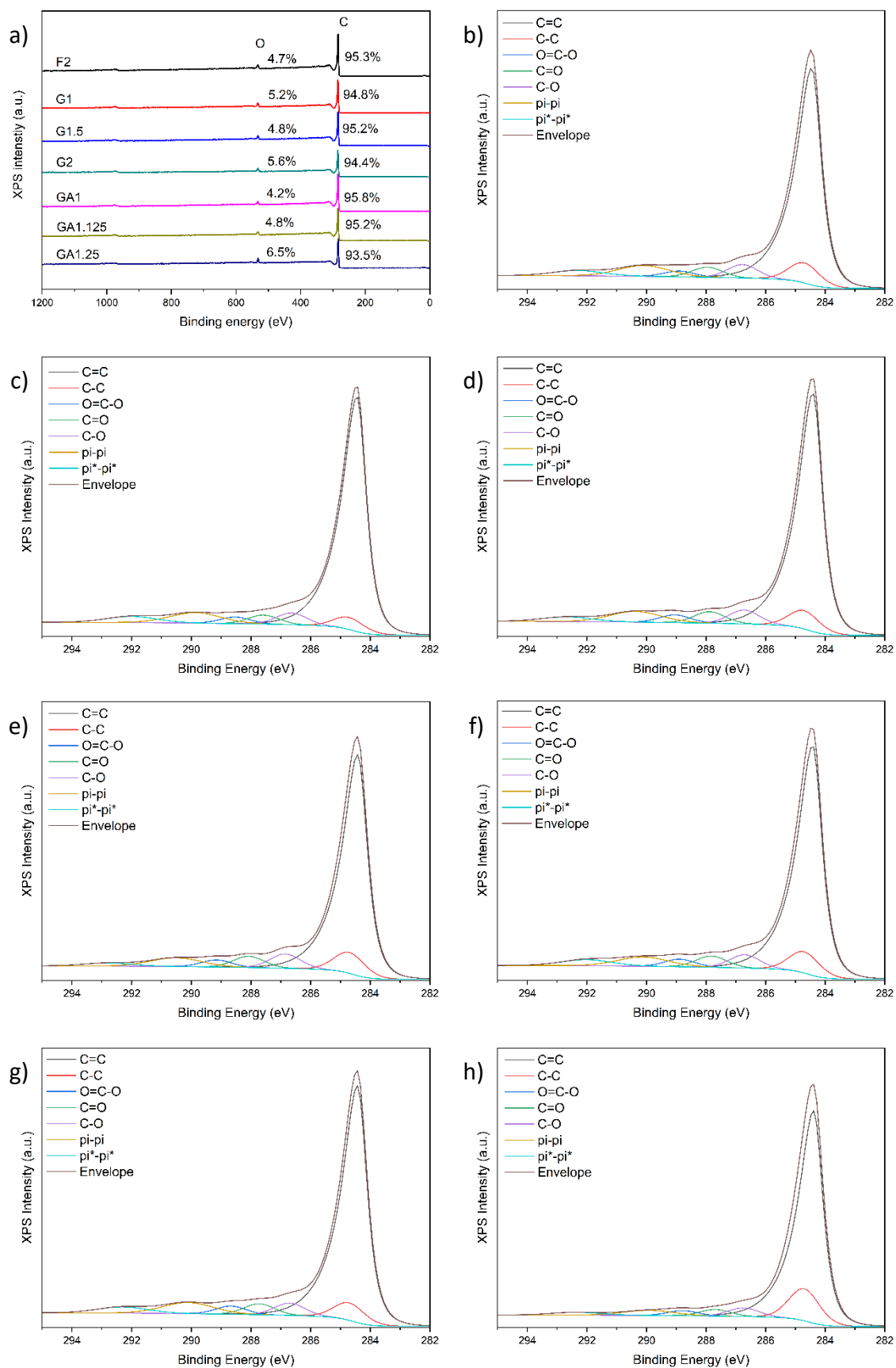


Figure S4. Summary of wide-scan XPS spectra (a) and deconvolution of C 1s peaks for MCs (b-h): F2, G1, G1.5, G2, GA1, GA1.125, and GA1.25, respectively.

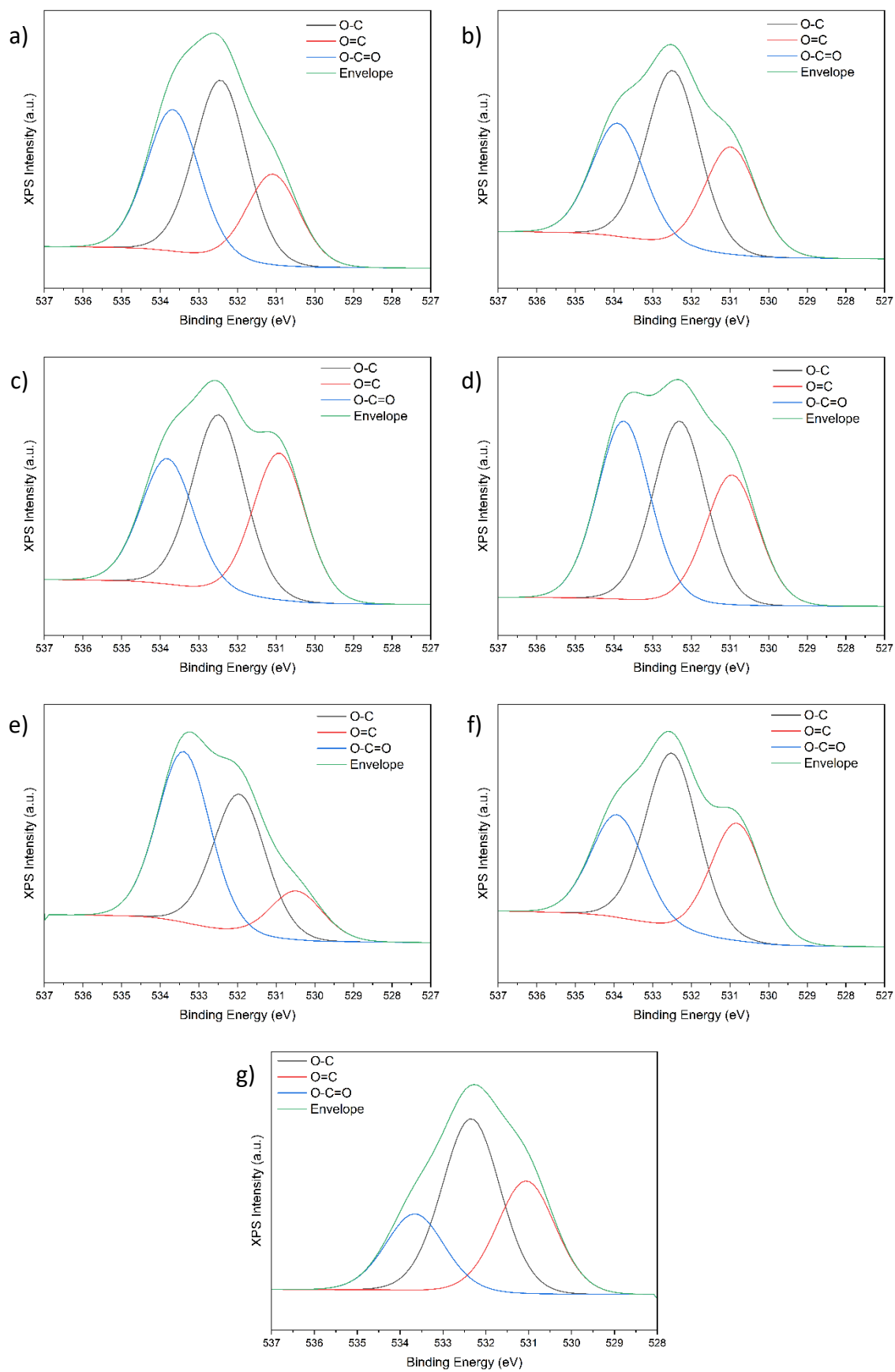


Figure S5. Deconvolution of XPS O 1s peaks for MCs (a-g): F2, G1, G1.5, G2, GA1, GA1.125, and GA1.25, respectively.

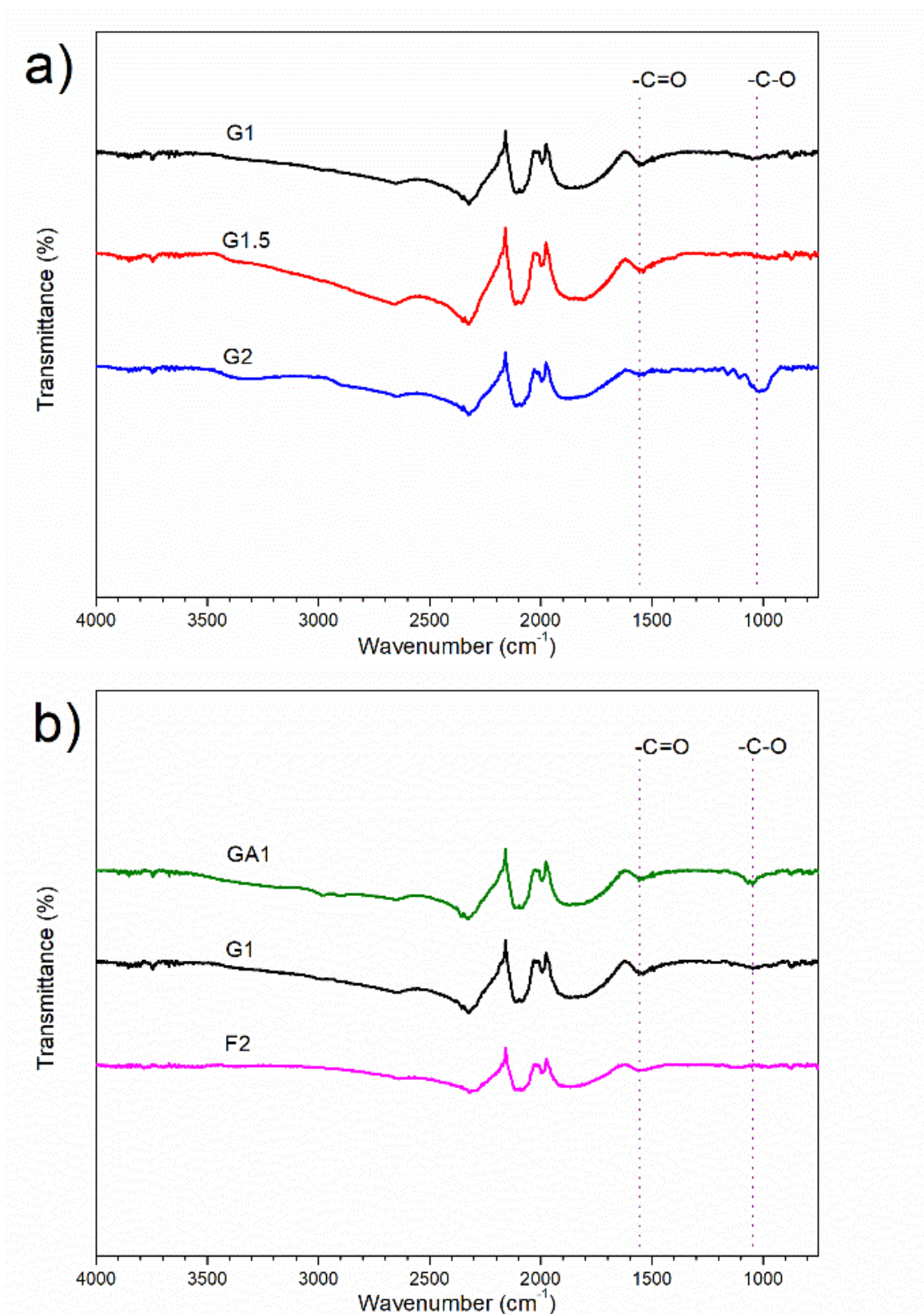


Figure S6. IR spectra: a) MCs prepared by glyoxal cross-linker, and b) comparison of MCs with different cross-linkers.

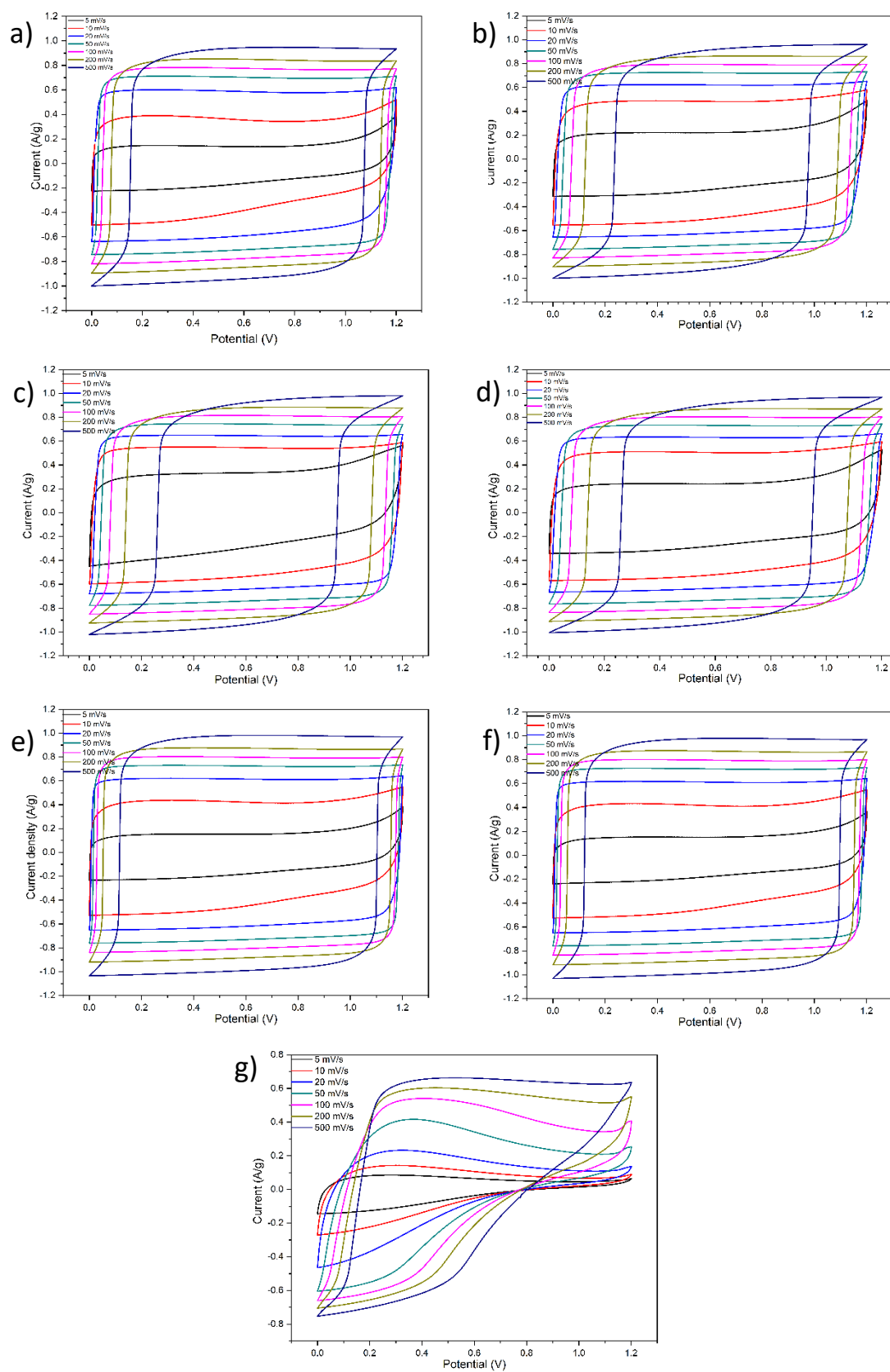


Figure S7. CV test for all MCs in 6 M KOH electrolyte at various scan rates from 5 to 500 mV/s: a-g) F2, G1, G1.5, G2, GA1, GA1.125, and GA1.25, respectively.



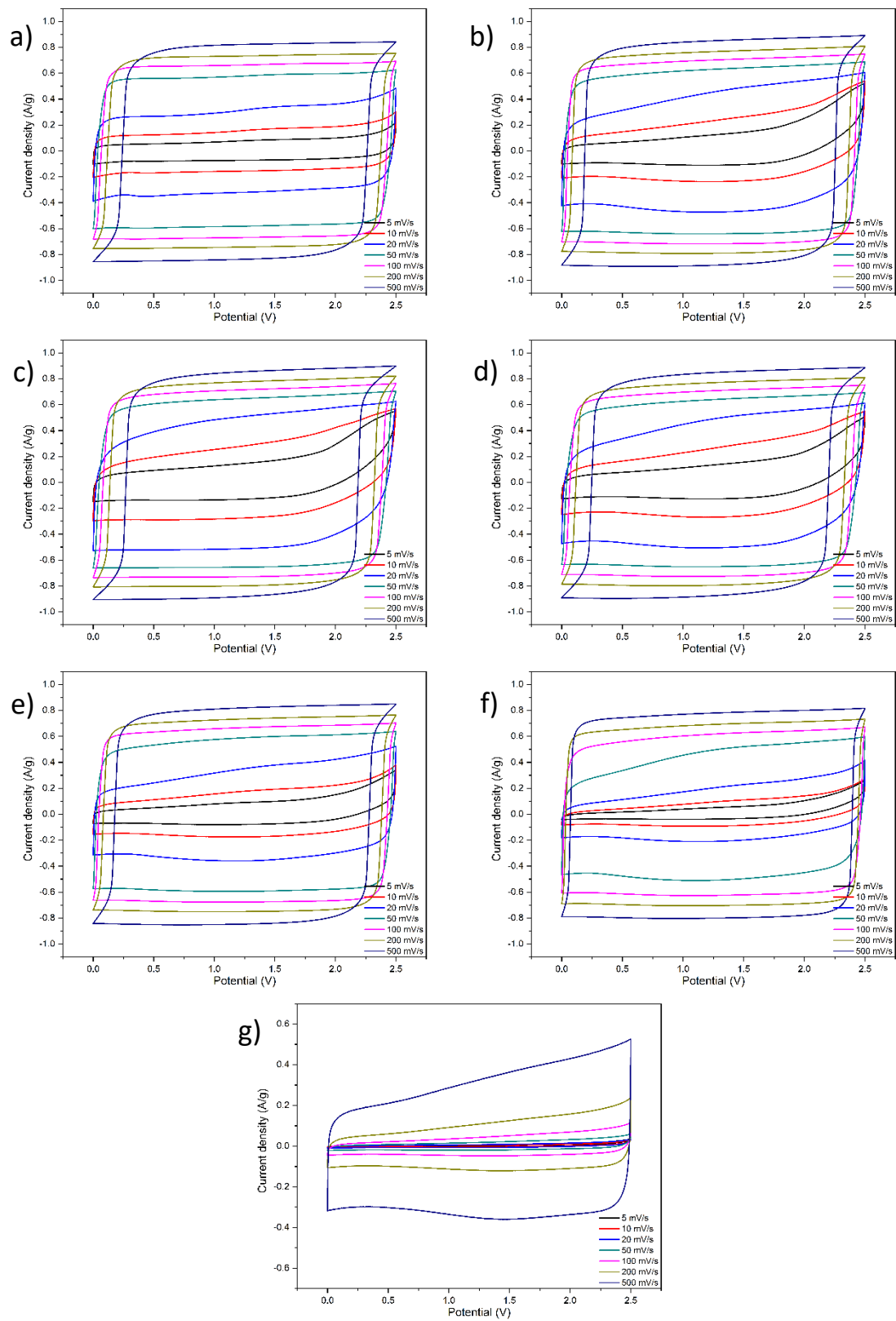


Figure S8. CV test for all MCs in  $[N_{2220}][NTf_2]/ACN$  electrolyte at various scan rates from 5 to 500 mV/s: a-g) F2, G1, G1.5, G2, GA1, GA1.125, and GA1.25, respectively.

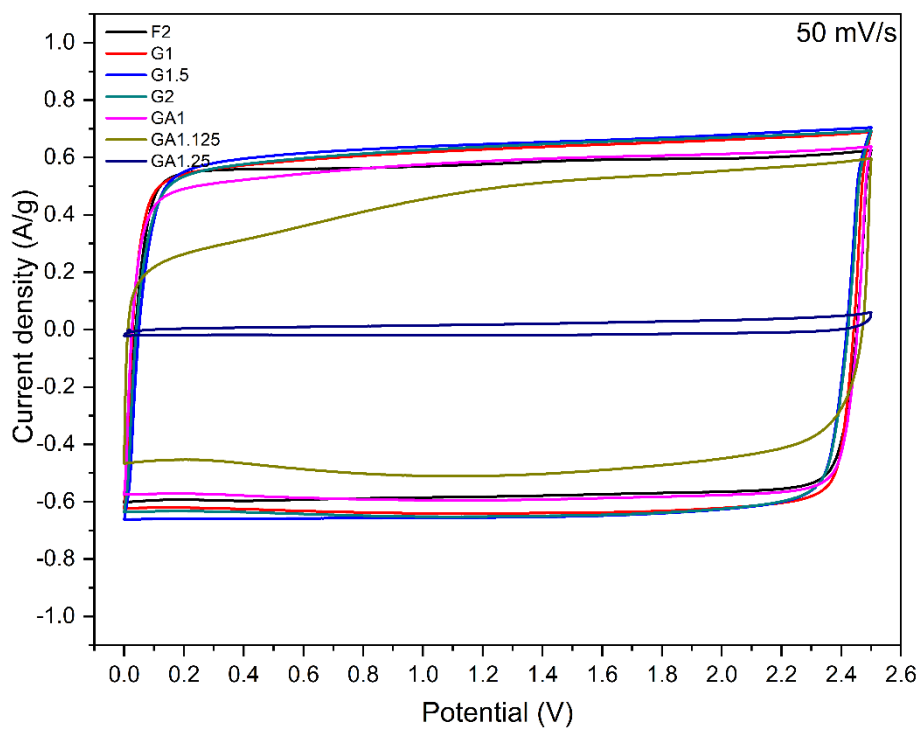
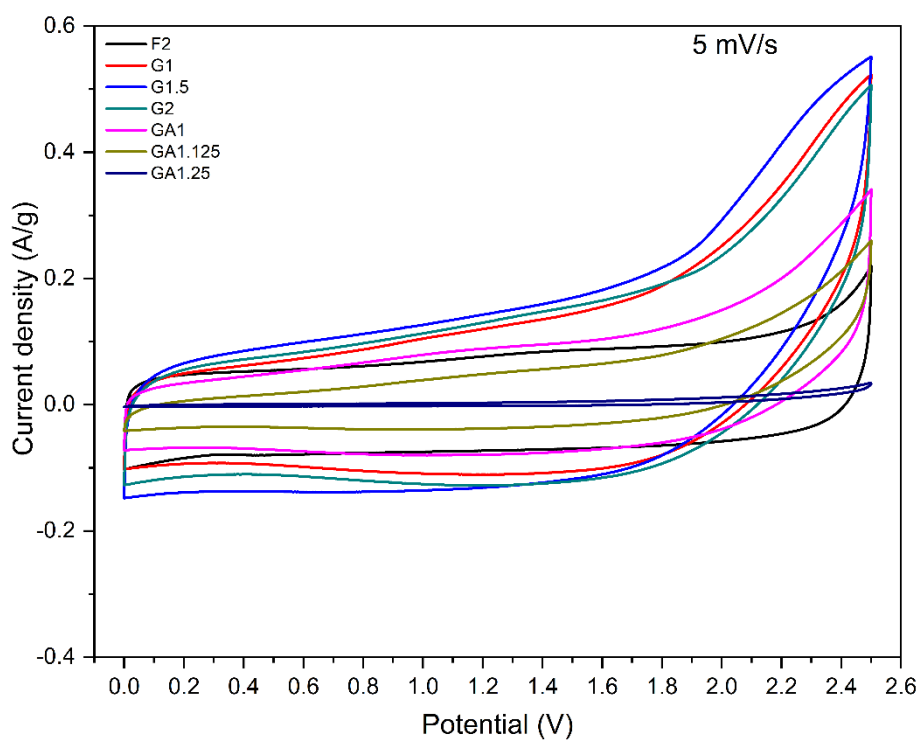


Figure S9. CV test for all MC electrodes in  $[N_{2220}][NTf_2]/ACN$  electrolyte at a scan rate of 5 and 50 mV/s, respectively.

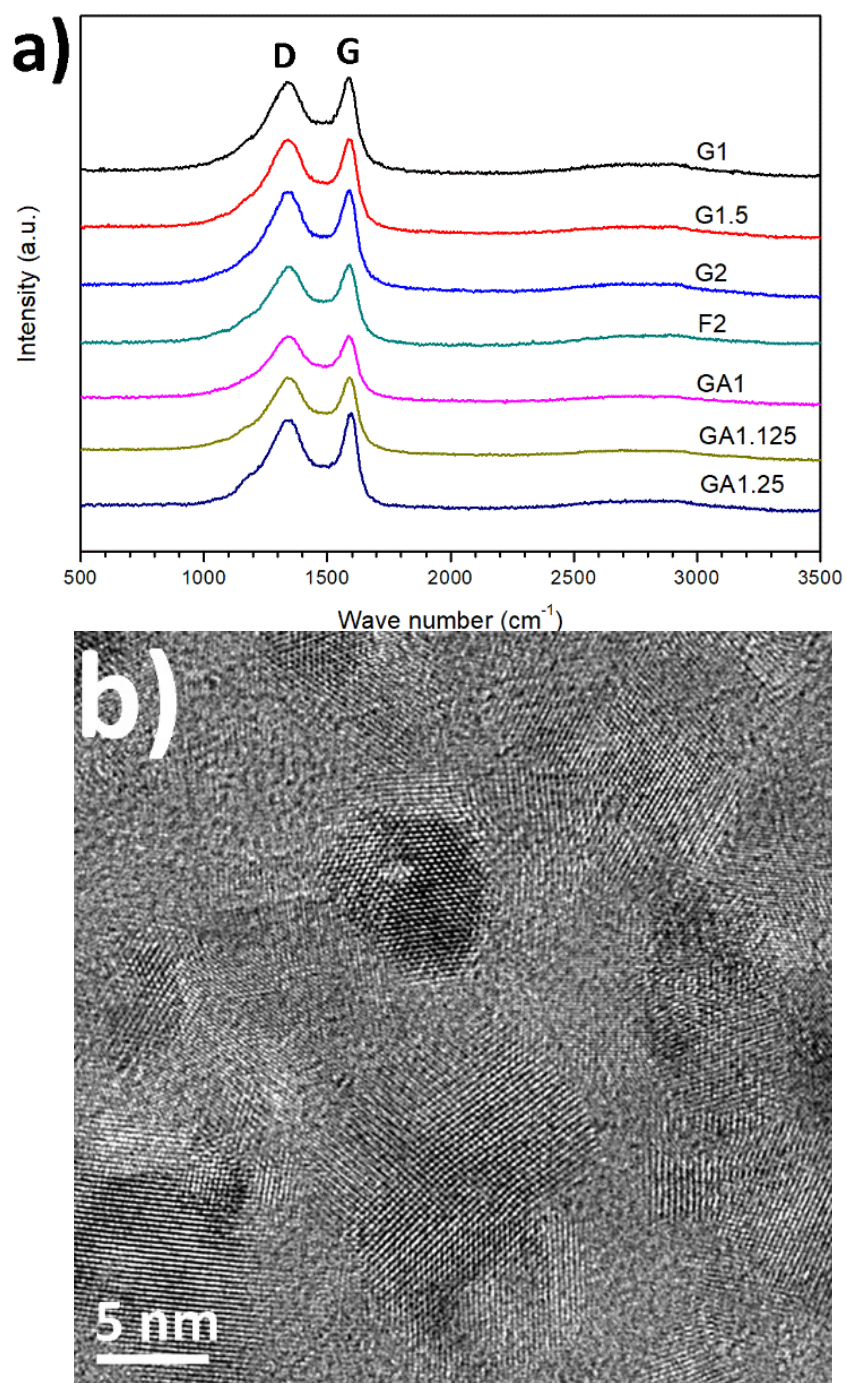


Figure S10. a) Raman spectra of resultant MC samples, and b) representative TEM image of random graphite crystalline structures in sample F2.