Electronic Supplementary Material (ESI) for Materials Advances.

Highly conductive biocarbon nanostructures from burlap waste as a sustainable additive for supercapacitor electrodes

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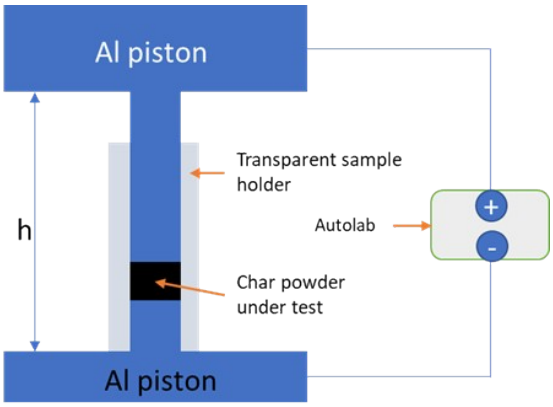
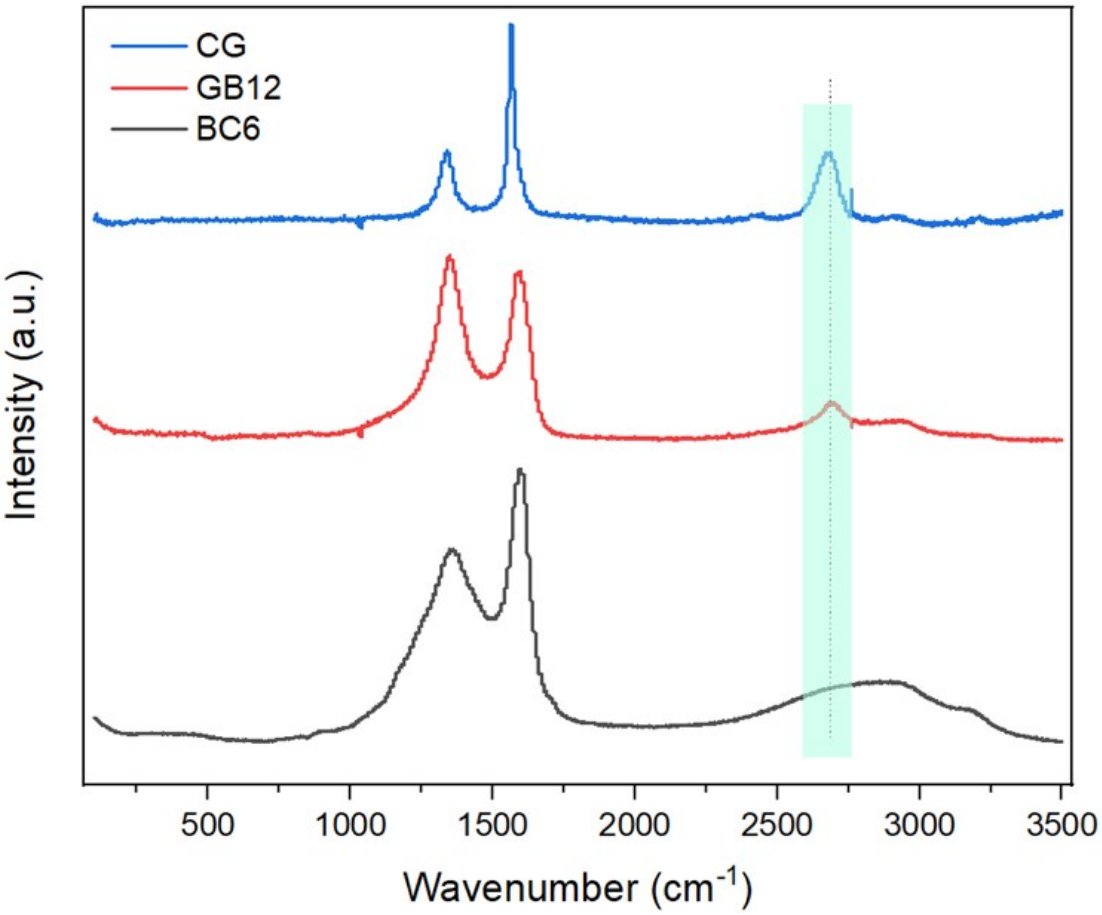
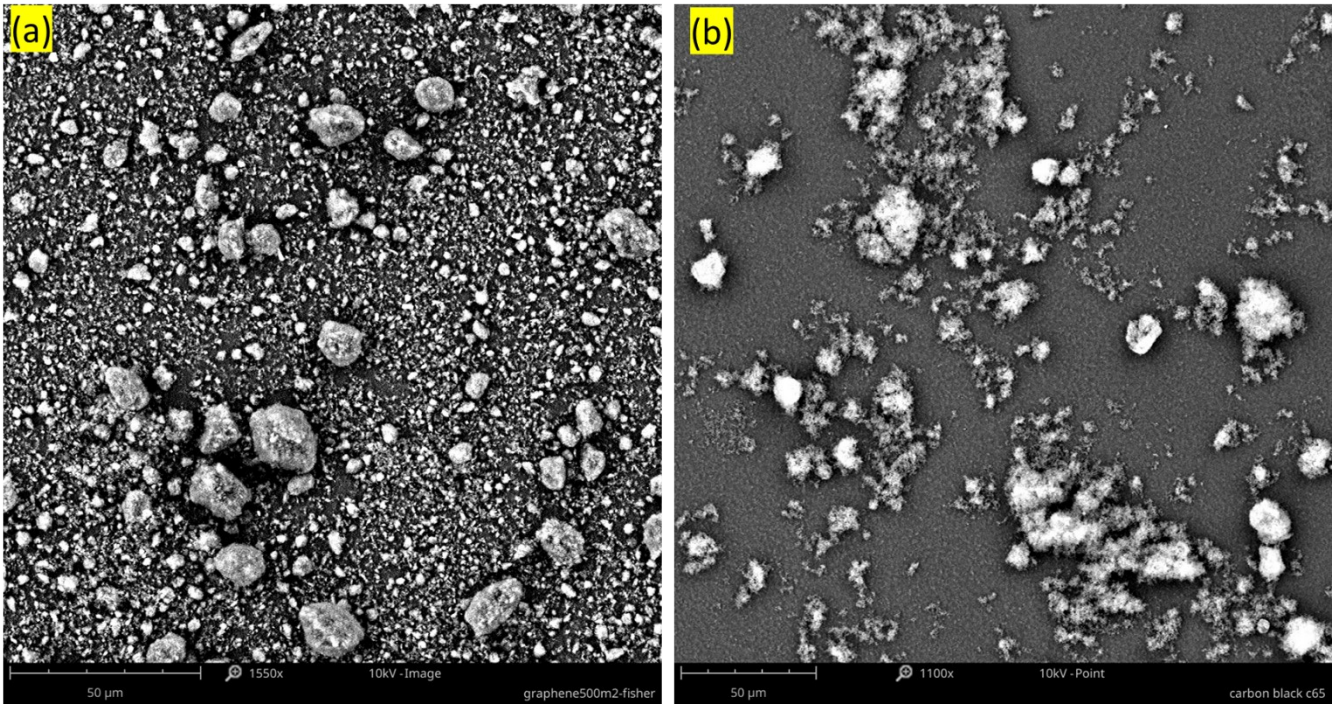


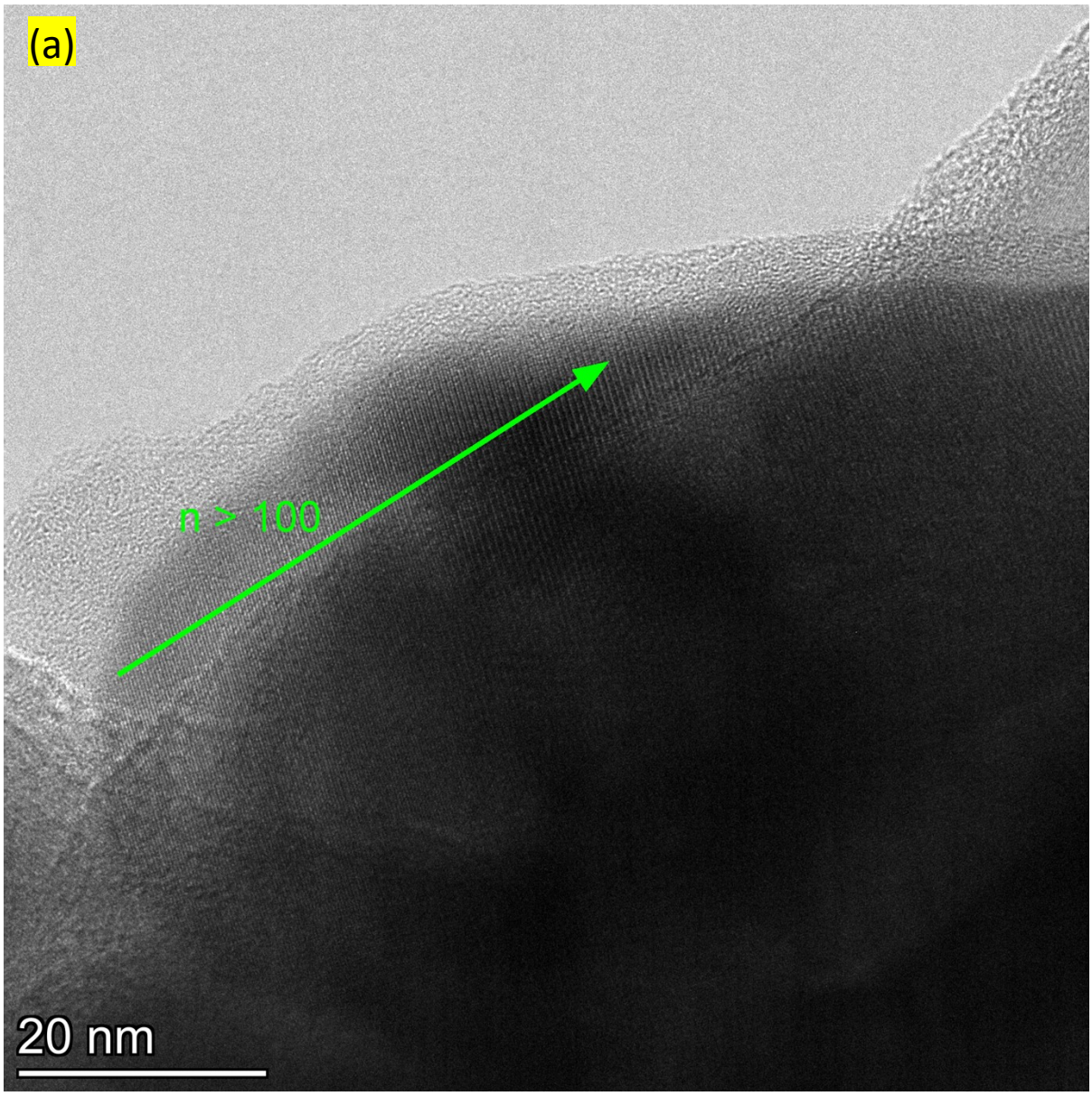
Supplementary Fig. 1. Schematic illustrations of the experimental device for measuring electrical resistance of the powders.

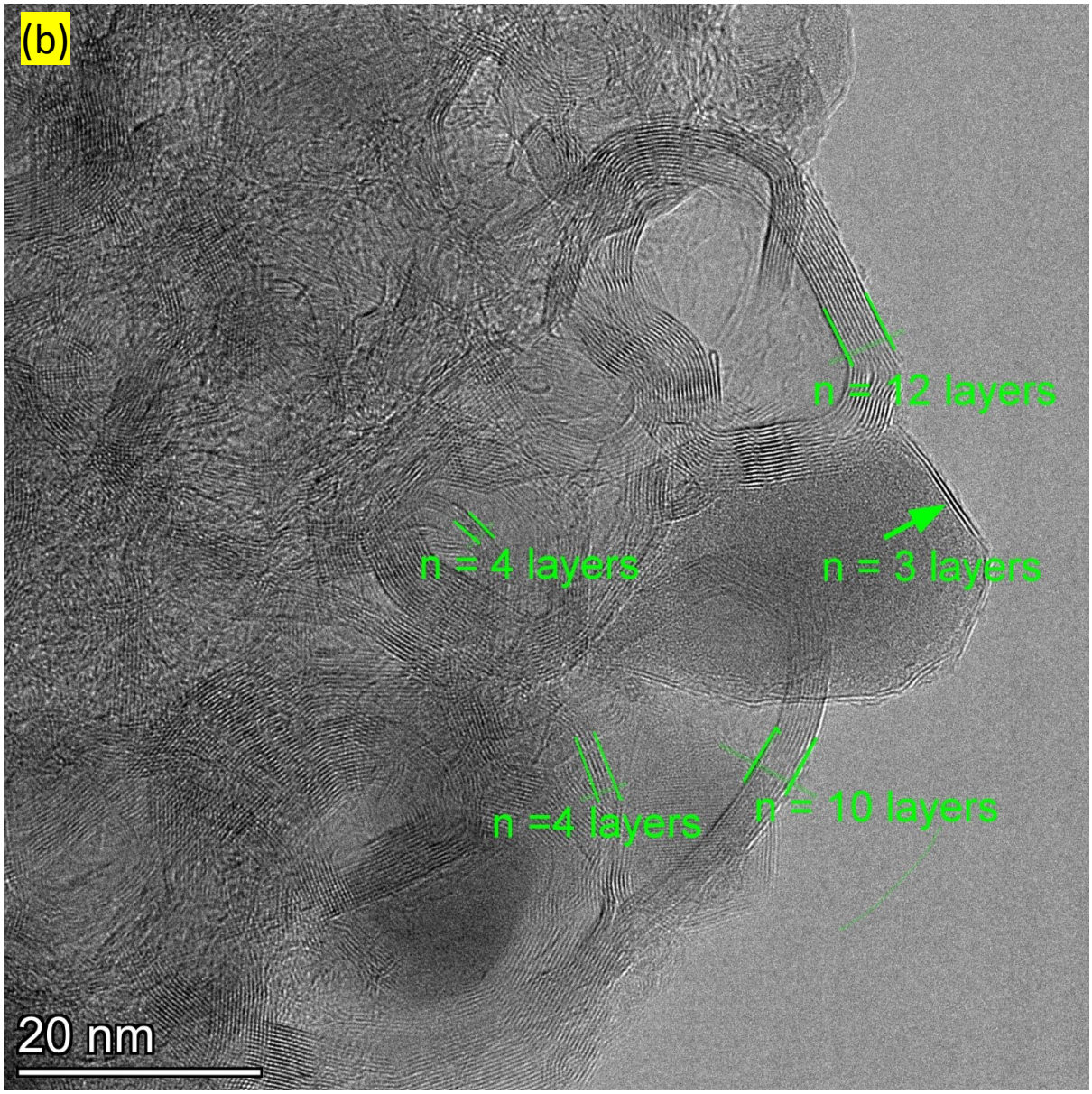


Supplementary Fig. 2. Full Raman spectra. Burlap carbon produced at 600°C (BC6), burlap carbon produced at 1200°C with iron nitrate catalyst (GB12) and the commercial grade graphene (CG). The peak around 2700 cm^{-1} for CG and GB12 is associated with the few numbers of graphene sheets in the samples.



Supplementary Fig. 3. SEM images of the commercial grade graphene (CG) (a) and carbon black (SP) (b). The particles in the commercial grade graphene form aggregate agglomerates and increased the contact resistance, resulting in reduced conductivity. The carbon black used in this work is amorphous carbon and has fluffy structure which also can form spherical agglomerates leading to lower conductivity values.


(a)
n > 100
20 nm



Supplementary Fig. 4. HRTEM images. Burlap-based biocarbon produced at 600°C (a), and burlap-based graphitic biocarbon produced with iron nitrate catalyst at 1200°C, showing few layers (3-12) of graphene sheets (b)