

Fabrication of Flexible All-Solid-State Asymmetric Supercapacitor Device via Full Recycling of Heated Tobacco Waste Assisted by PLA Gelation Template Method

Suk Jekal ^{1,†}, Min-Sang Kim ^{1,†}, Dong-Hyun Kim ¹, Jungchul Noh ², Ha-Yeong Kim ¹, Jiwon Kim ¹, Hyeonseok Yi ³, Won-Chun Oh ⁴ and Chang-Min Yoon ^{1,*}

- ¹ Department of Chemical and Biological Engineering, Hanbat National University, Daejeon 34158, Republic of Korea; neofgreen@hanbat.ac.kr (S.J.); 20181304@edu.hanbat.ac.kr (M.-S.K.); 20181302@edu.hanbat.ac.kr (D.-H.K.); 20191363@edu.hanbat.ac.kr (H.-Y.K.); 20191360@edu.hanbat.ac.kr (J.K.)
- ² McKetta Department of Chemical Engineering and Texas Material Institute, The University of Texas at Austin, Austin, TX 78712, USA; jn0118@utexas.edu
- ³ Institute for Materials Chemistry and Engineering, Kyushu University, Fukuoka 816-8580, Japan; yi@cm.kyushu-u.ac.jp.
- ⁴ Department of Advanced Materials Science & Engineering, Hanseo University, Seosan-si 31962, Republic of Korea; wc_oh@hanseo.ac.kr.
- * Correspondence: cmyoon4321@hanbat.ac.kr; Tel.: +82-42-821-1528; Fax: +82-42-821-1593
- † These authors equally contributed to this work.

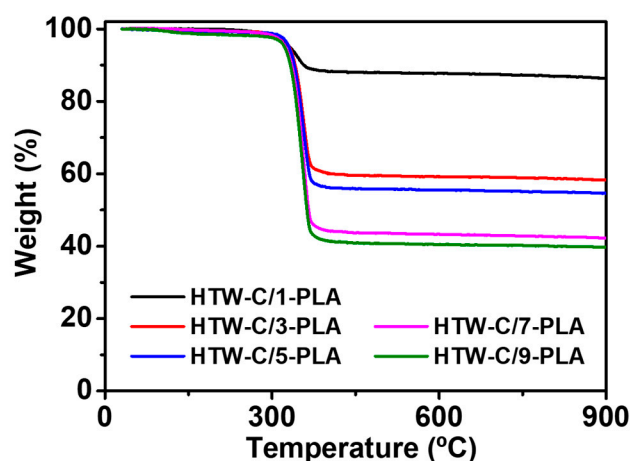


Figure S1. TGA curves of HTW-C/PLA electrodes according to number of PLA filters.

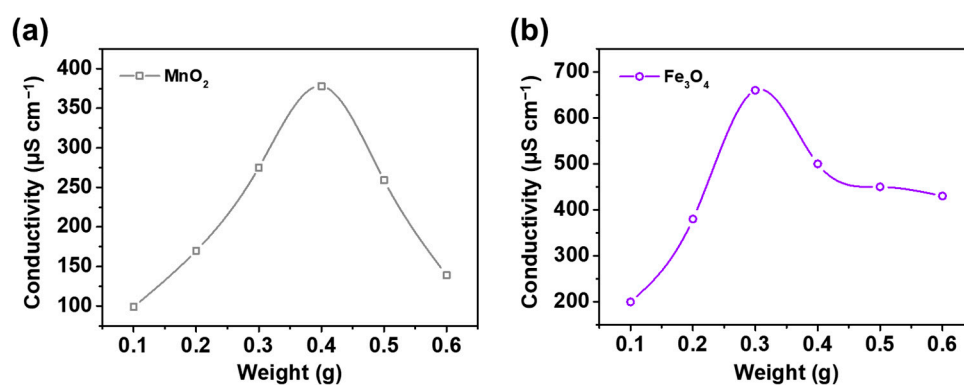


Figure S2. Electrical conductivities of C-MnO₂/PLA and C-Fe₃O₄/PLA electrode according to the added amount of MnO₂ and Fe₃O₄ materials, respectively.

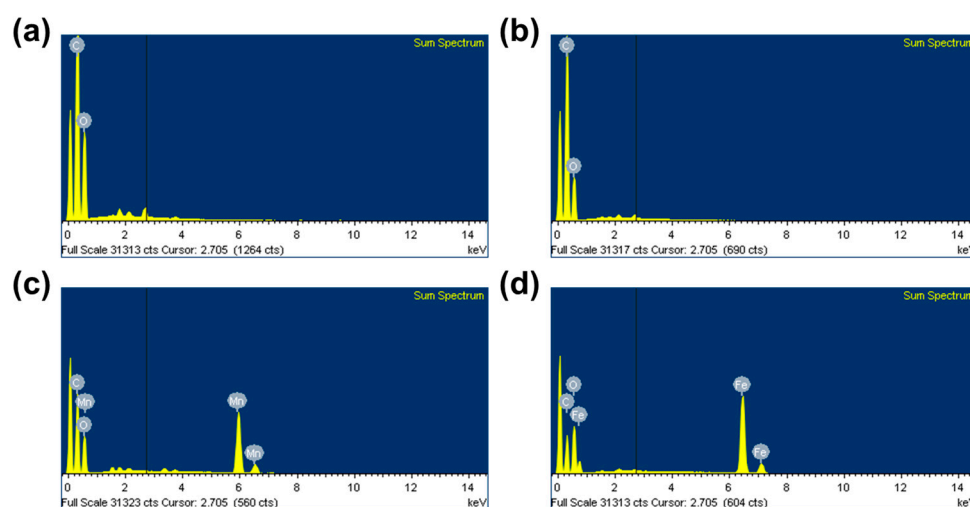


Figure S3. EDS spectra of (a) PLA substrate, (b) HTW-C/PLA, (c) C-MnO₂/PLA, and (d) C-Fe₃O₄/PLA (detected elements : C, O, Mn and Fe)

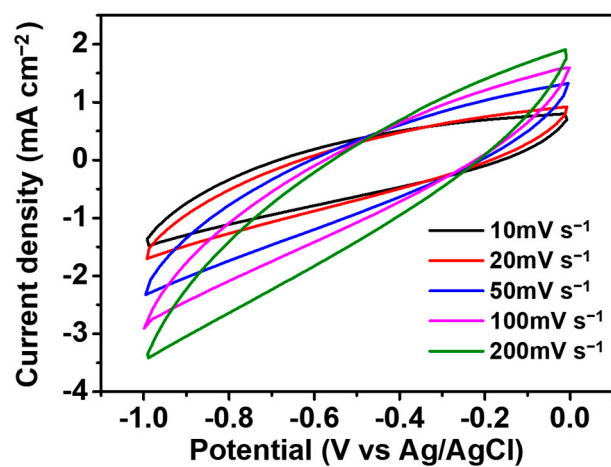


Figure S4. Cyclic voltammetry (CV) curves of HTW-C/PLA at various scan rates.

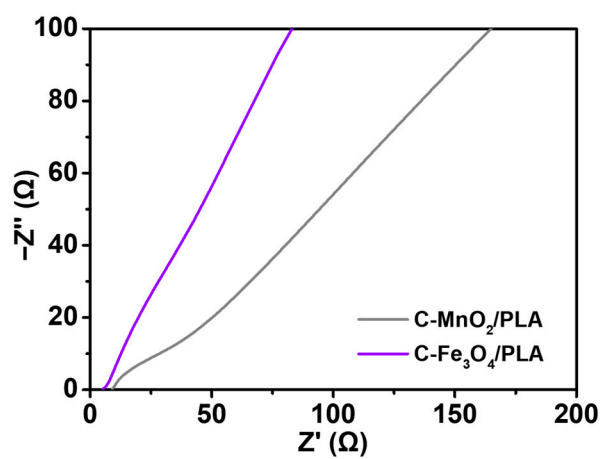


Figure S5. Electrochemical impedance spectroscopy (EIS) analysis of C-MnO₂/PLA and C-Fe₃O₄/PLA.