Supporting information

Improve the Operational Stability and Durability of Proton Exchange Membrane Fuel Cell by Using a Novel Lignin-Containing Nanocellulose Fibers Modified Carbon Fiber Paper

Ruyin Ma [a#], Yunfei Zhang [a#], Jinghang Zhu[b], Daliang Guo [a *], Jianbin Chen [a, **], Linxin Zhong[c], Chengliang Duan[a], Yinchao Xu[a], Jing Li[a], Huifang Zhao[a], Lizheng Sha[a]

[a] School of Environmental and Nature Resources, Zhejiang University of Science & Technology, Hangzhou, Zhejiang Province, 310023, China

[b] Longyou Economic Development Zone Entrepreneurship and Innovation Service Center, Longyou County, Zhejiang, 324404, China

[c] State Key Laboratory of Pulp and Paper Engineering, South China University of Technology, Guangzhou 510641, China

[#]These authors contributed equally to this paper.

*Corresponding authors: Tel: +86 057185070781; E-mail: 08guodaliang@163.com

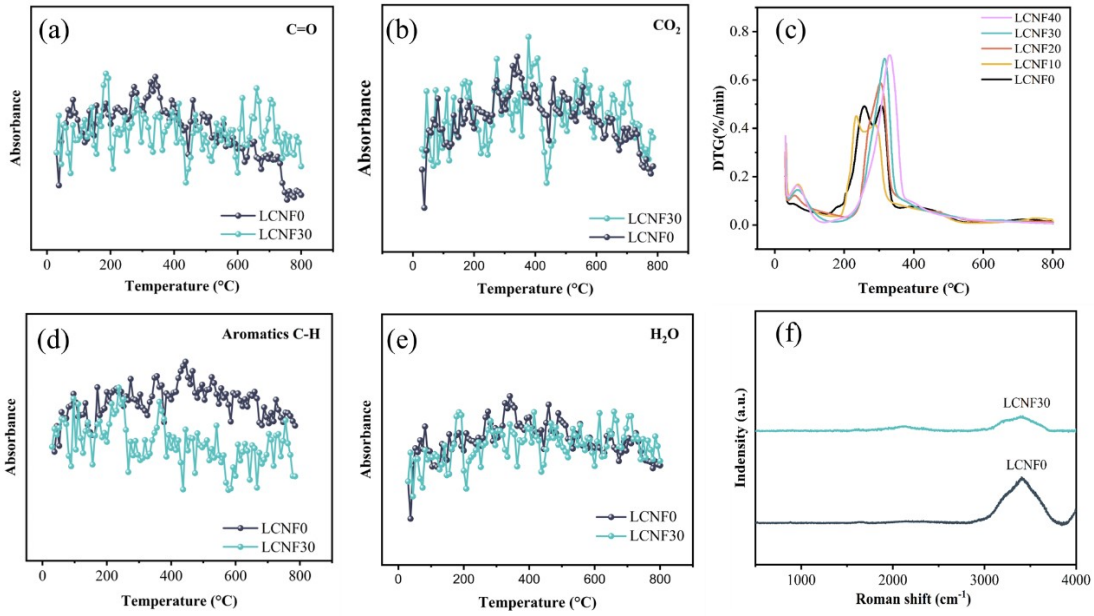

Figure S1. Release patterns of (a) C=O, (b) CO_2, (d) aromatic C-H, (e) H_2O in the pyrolysis products of LCNF0 and LCNF30, (c) DTG images and (f) Raman spectra of LCNF samples.

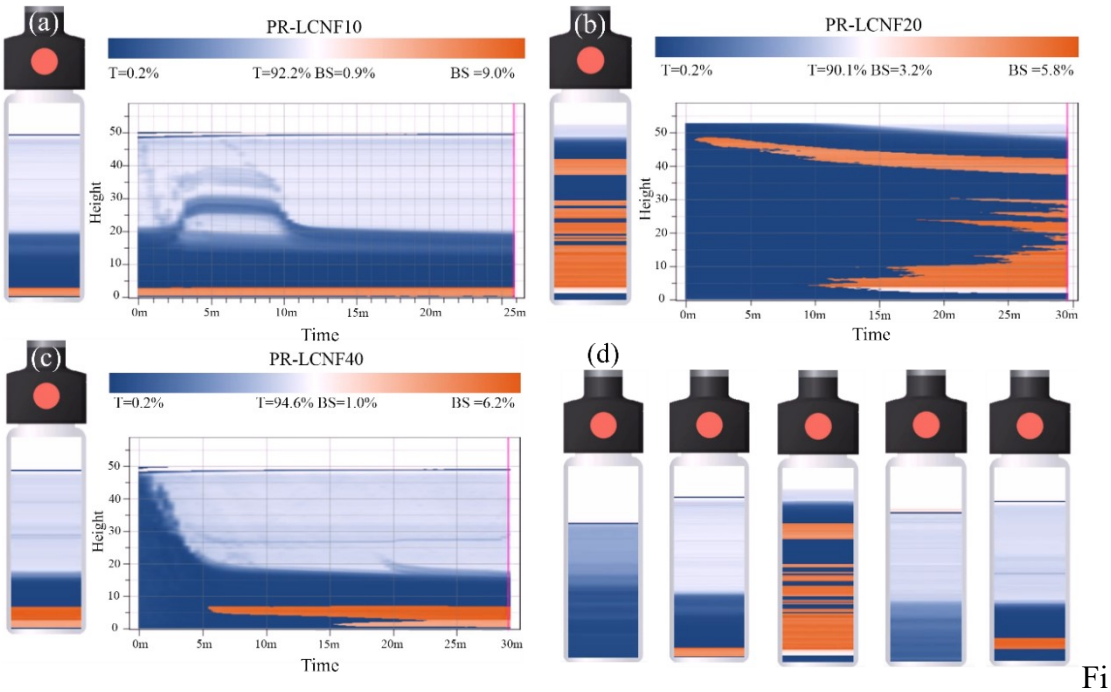

Figure S2. Trend chart of backscattered light intensity variation during the dispersion process of modified PR suspension.

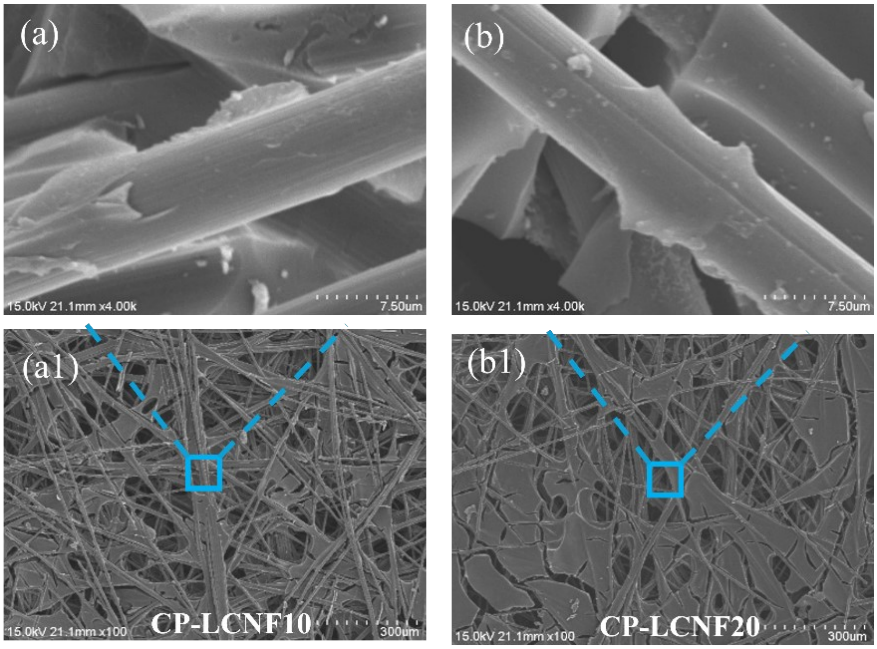

Figure S3. SEM analysis of LCNF-modified CP with different lignin contents: (a-b) Carbon fiber (a1-b1) CP surface.

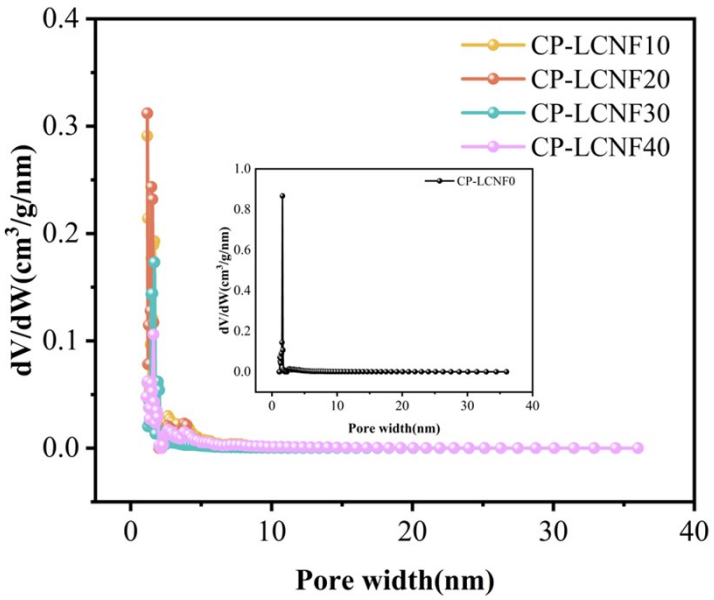

Figure S4. Pore size distribution of LCNF-modified CP with different lignin contents.

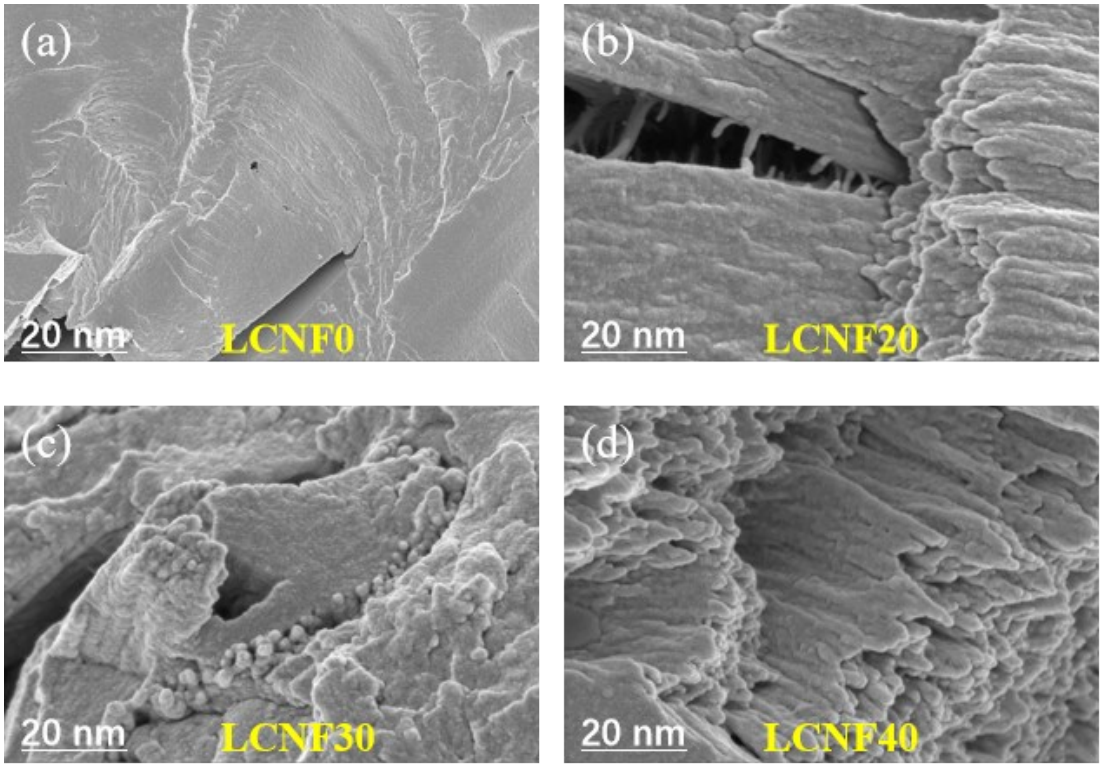

Figure S5. SEM images of PF modified by LCNF with different lignin contents after curing.

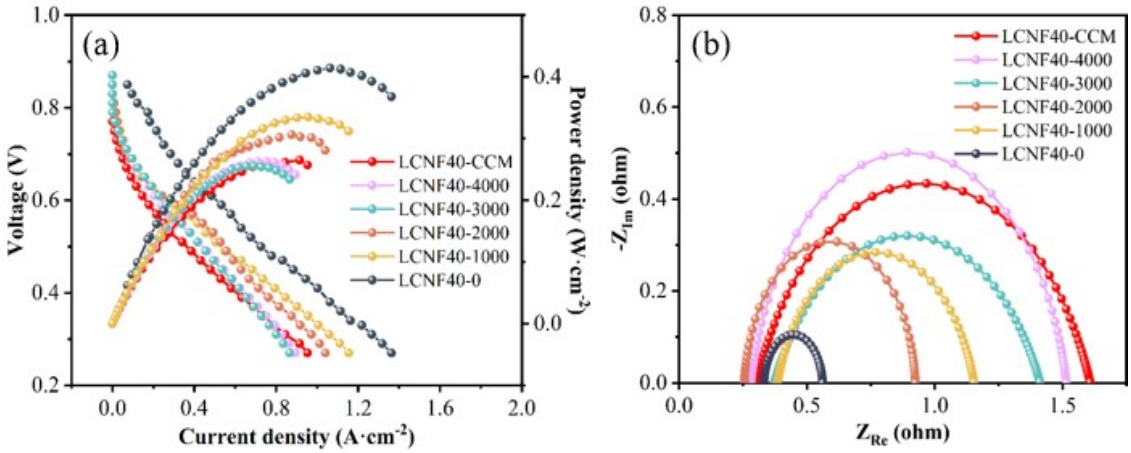

Figure S6. (a) Polarization curves and power density plots of CP-LCNF40 after cyclic aging at 0.6~0.95 V, (b) EIS plots.