

Supplementary Information

Controlling Platinum Loading in PEMFC Membrane Electrodes by Sputtering Time: A Systematic Study from Ultra-Low to High Loading for Optimal Performance

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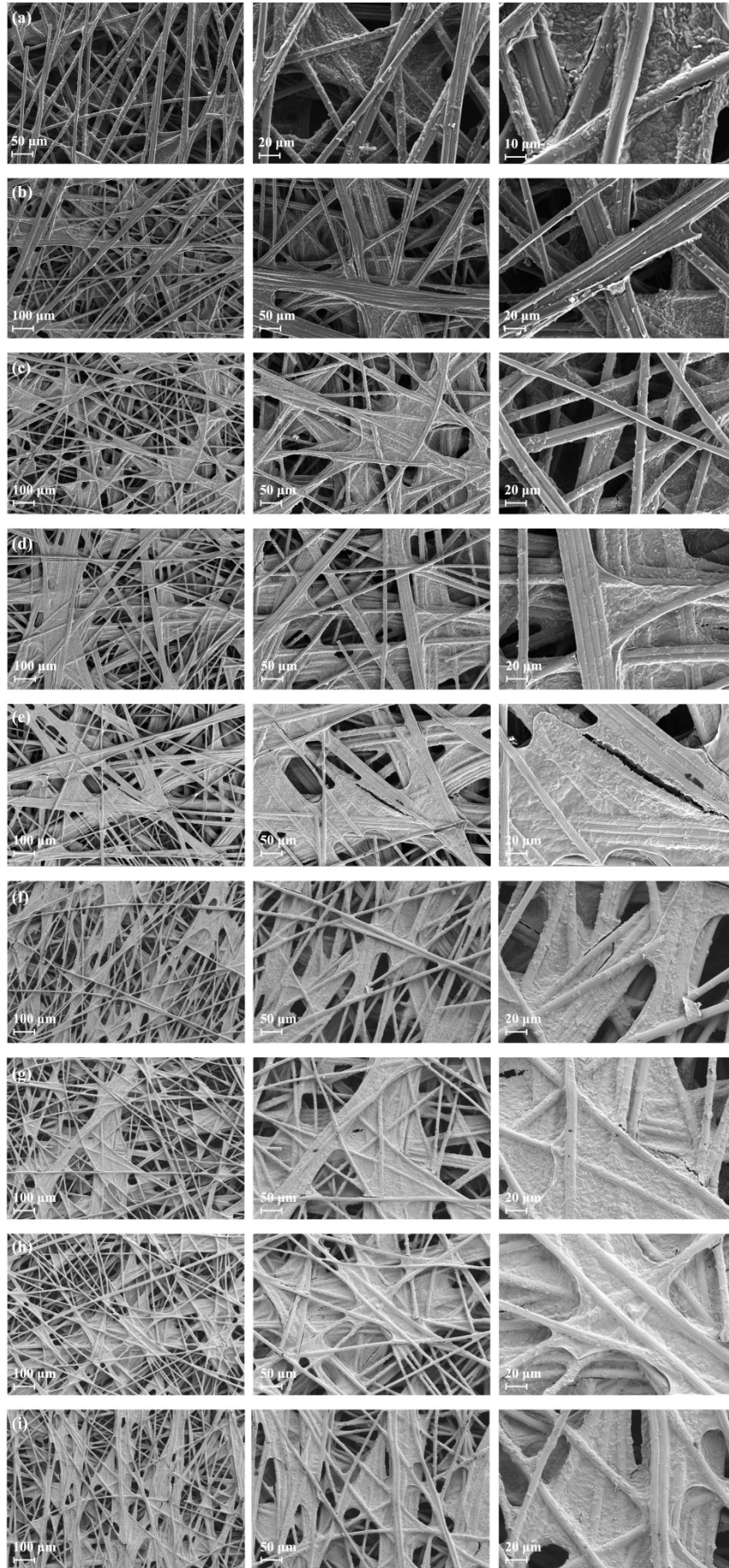


Figure S1. SEM images at three different magnifications for carbon paper substrate under varying sputtering durations: (a) carbon paper, (b) 10 s, (c) 30 s, (d) 60 s, (e) 120 s, (f) 180 s, (g) 240 s, (h) 300 s, and (i) 360 s.

Fig S1 from left to right shows: low, medium, and high magnification. By progressively zooming into selected areas from the macro scale, both the overall morphology and microstructural features can be obtained. The images clearly demonstrate that as the sputtering time increases, the surface coating coverage increases significantly, and the catalytic layer gradually evolves into a thin-film-like state.