

Supporting Information

The Microporous Layer Containing CeO₂-doped 3D Graphene Foam for Proton Exchange Membrane Fuel Cells at Varying Operating Condition

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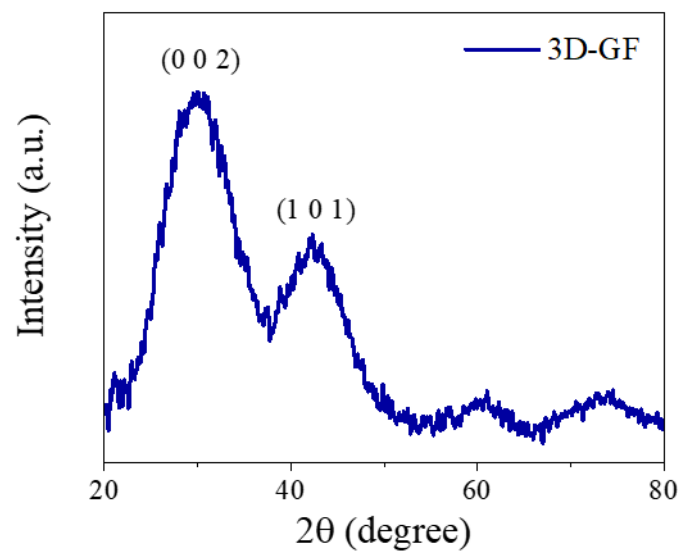


Figure S1 XRD pattern of 3D-GF

As shown in **Figure S1**, two diffraction peaks of 3D graphene foam can be observed, corresponding to the (0 0 2) and (1 0 1) planes, respectively. The same material has been reported in the literature (Advanced Materials 2013, 25 (17), 2474-2480.).

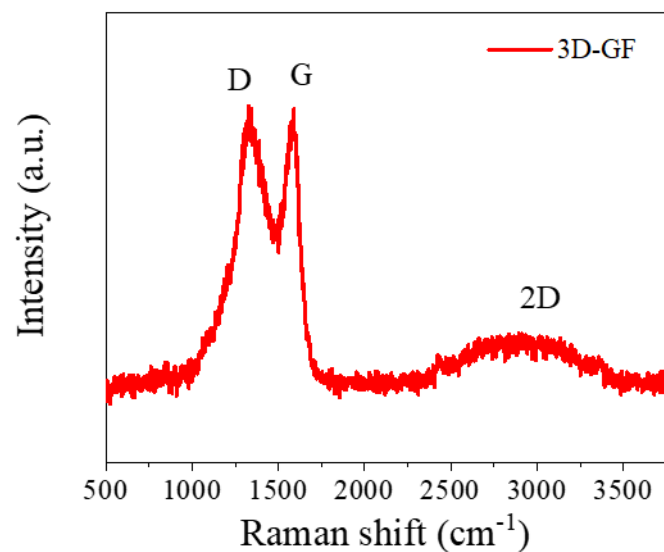


Figure S2 Raman spectra of 3D-GF

Figure S2 shows the Raman spectra of 3D graphene foam. Peak position of the D band, G band and 2D band locate at 1350 cm⁻¹, 1580 cm⁻¹ and 2800 cm⁻¹. The broad peak of 2D band indicates that the 3D graphene foam consists of few-layer graphene. The same material has been reported in the literature (Journal of Alloys and Compounds 2020, 834, 155096.).

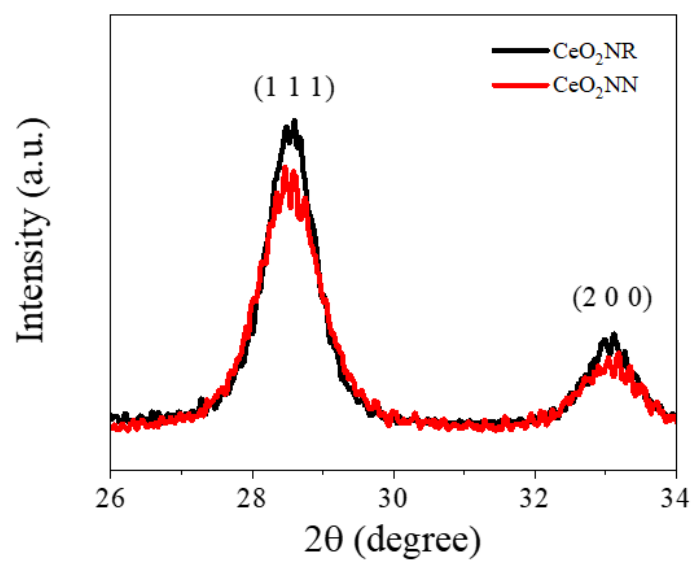


Figure S3 The magnified XRD patterns of CeO₂ nanorods and CeO₂ nano-network on the 3D-GF.

As shown in **Figure S3**, the intensity of CeO₂NR at (1 1 1) plane is obviously higher than that of CeO₂NN. It indicating that CeO₂NN is composed of smaller particles.

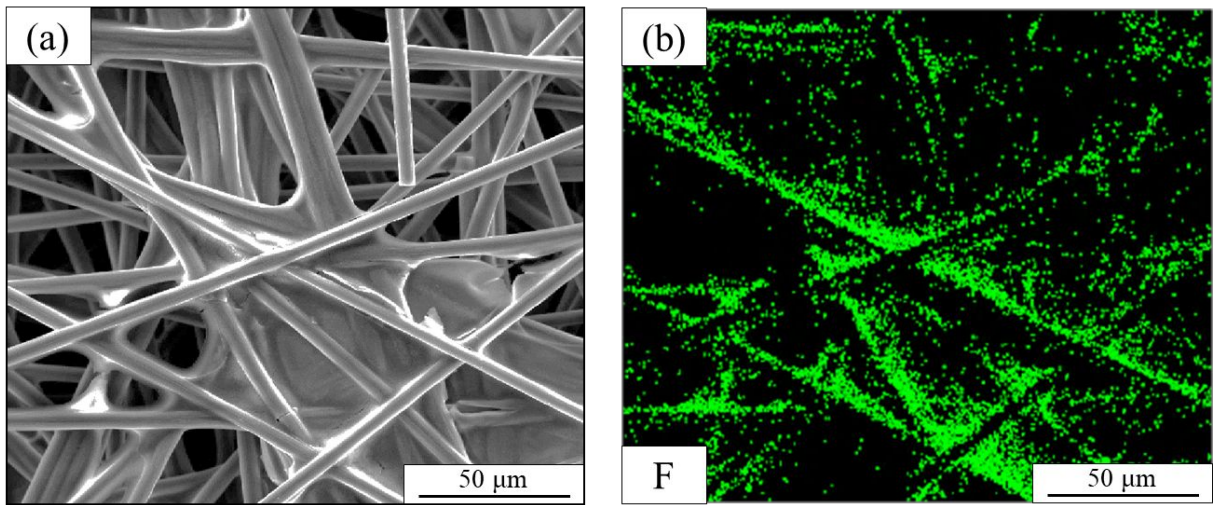


Figure S4 (a)The SEM image of MPS, (b) EDS mapping images of MPS

As shown in **Figure S4**, this MPS is composed of disorderly carbon fibers. At the boundary points between the fibers, an aggregation of material is observed. It is the residuum of pyrolyzed resin binder during the production process of MPS. After the subsequent hydrophobic treatment, the PTFE particles tend to adhere at these regions, preventing water adhesion in the substrate.