Supporting Imformation

Ultra high performance multi-element doped mesoporous carbon catalyst derived from poly(4-vinylpyridine)

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Experimental

Preparation of SBA-15 template

The SBA-15 templates were prepared by using a triblock copolymer Plurionic P123 ($EO_{20}PO_{70}EO_{20}$, Mw~5800, Aldrich) as the soft templates through a procedures similar to the ones previously reported by Vinu[1] and Qiao[2].

Briefly, 4 g triblock copolymer Plurionic P123 was dispersed in 150 ml 2 M HCl solution and stirred for 4 hours gently. Subsequantly, 9 g tetraethylorthosilicate (TEOS) was added. The mixture was then stired vigorously for 6 min before it was aged for 24 h at 40 ^{o}C. Thereafter, the obtained gels were transfer into autoclaves and heated at 140 ^{o}C for 24 h. The as-prepared SBA-15 were collected by filtration, rinsed with deionized water, dried at 100 ^{o}C and finally calcined at 550 ^{o}C for 6 h in the air to obtain the final product.

Preparation of samples for thermogravimetrc analysis (TGA)

The PVPyFe for TGA and XPS measurements was obtained from poly(4-vinylpyridine) (PVPy) and $FeCl_3$, with the same mole ratio through a similar procedure to the one of the precursor preparation, but without any addition of SBA-15 template.

Characterization

Table S1 EA results of various catalysts

catalysts / Element	CPVFe-900 (wt%)	CPVFe-S-600 (wt%)	CPVFe-S-750 (wt%)	CPVFe-S-900 (wt%)
N	1.4	7.8	5.3	3.0
C	88.5	74.6	70.6	81.6
H	1.1	2.2	2.4	2.3

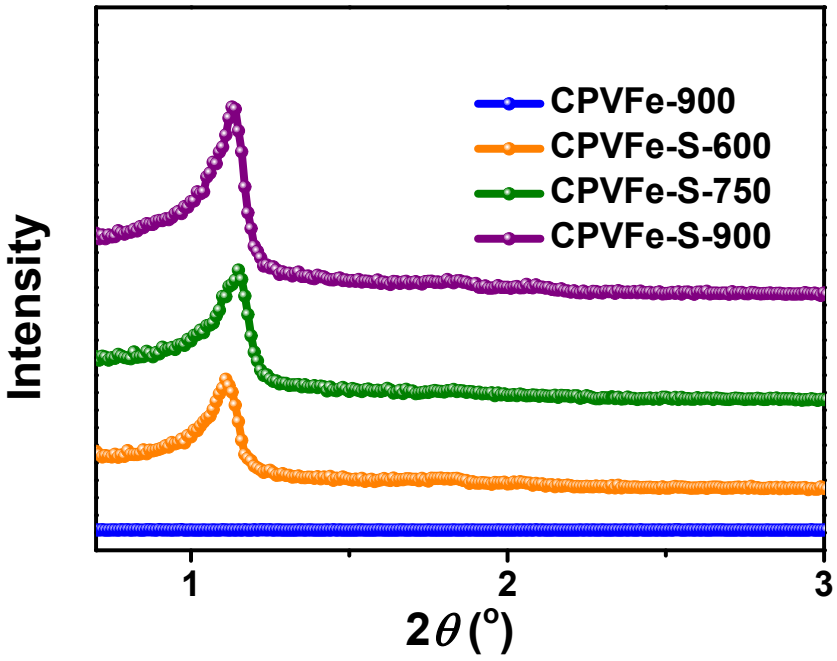

Fig. S1 Small-angle XRD patterns of the as-prepared catalysts

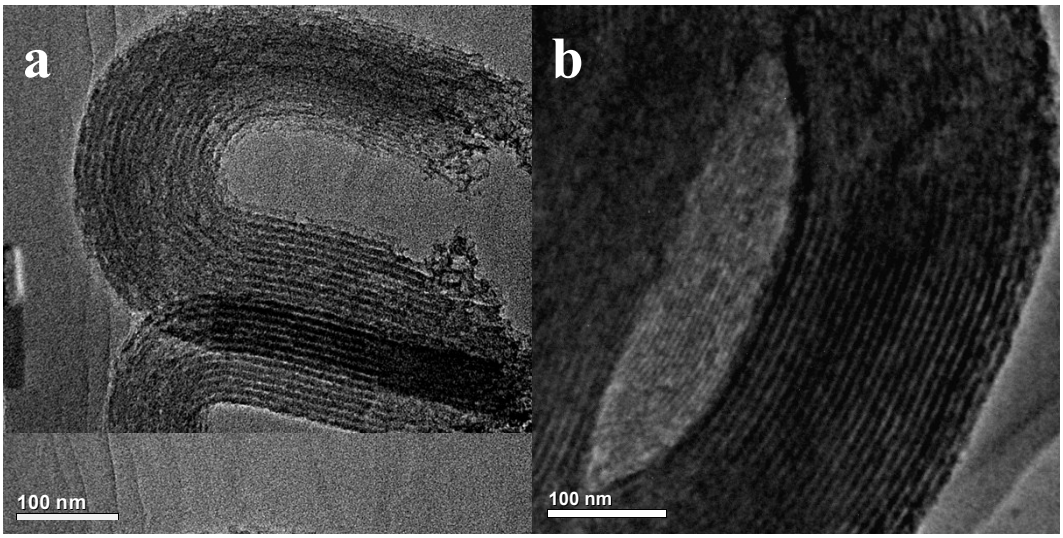

Fig. S2 TEM images: (a) CPVFe-S-600; (b) CPVFe-S-750

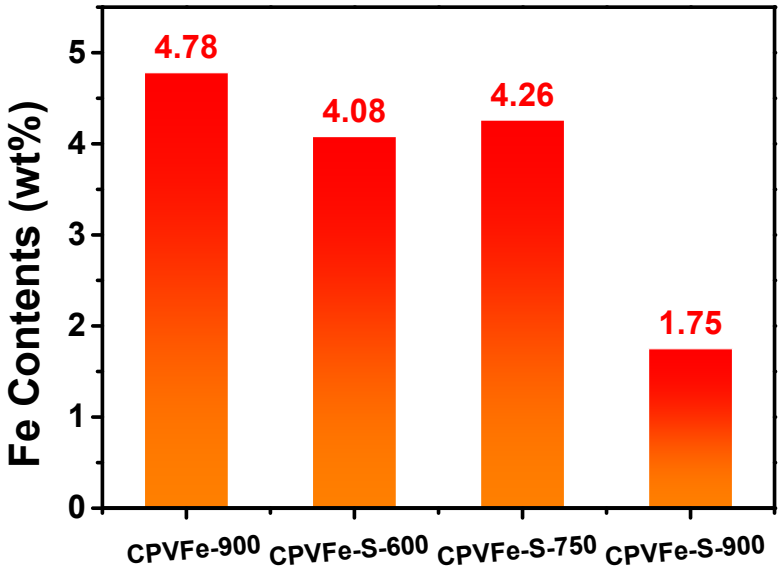

Fig. S3 ICP-AES results of various catalysts

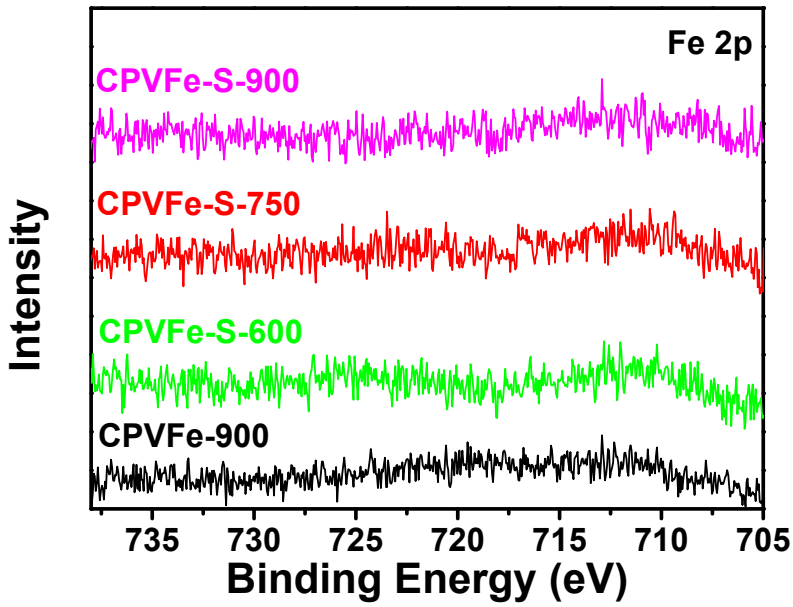

Fig. S4 High resolution Fe2p XPS spectra of various catalysts.

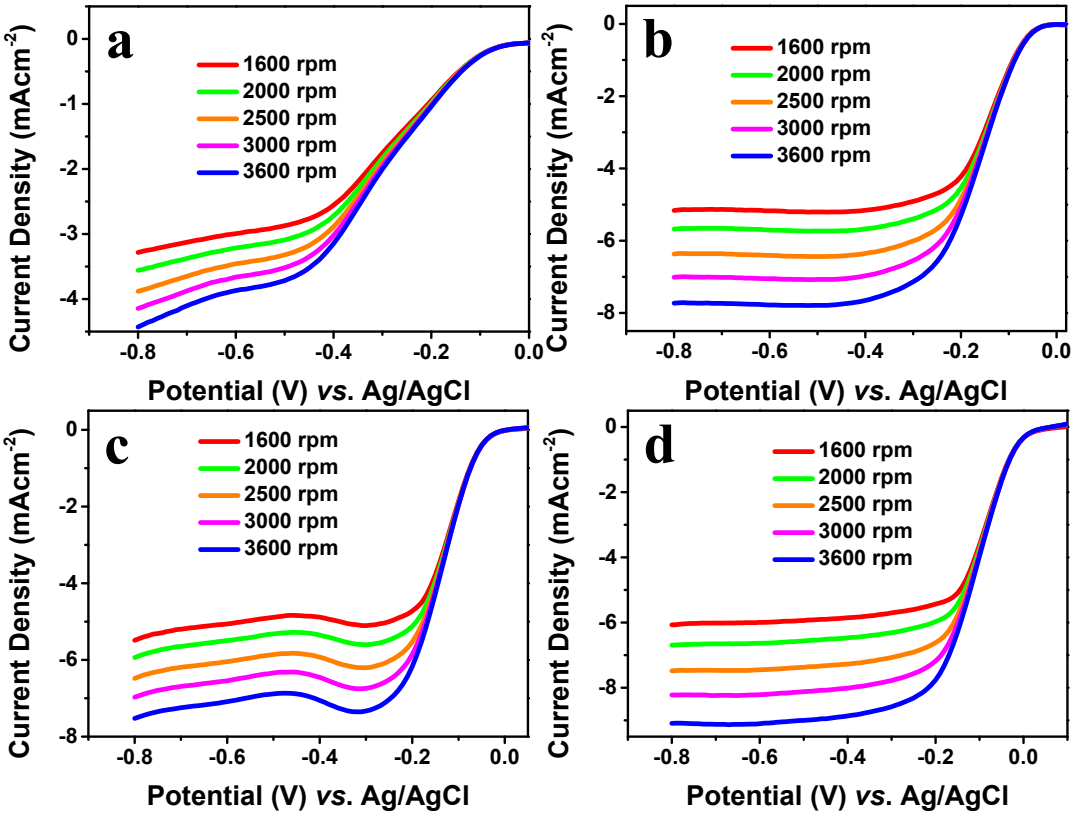

Fig. S5 LSV curves of various catalysts under different rotation rates: (a) CPVFe-900; (b) CPVFe-S-600; (c) CPVFe-S-750; (d) CPVFe-S-900.

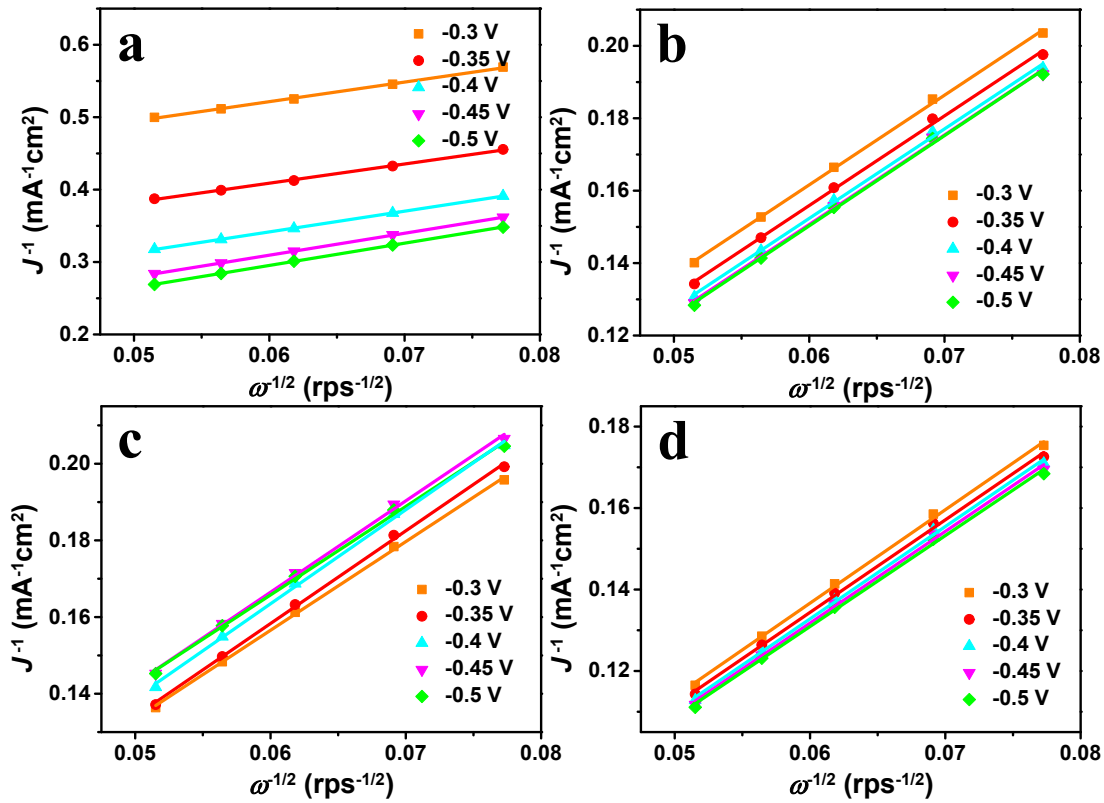

Fig. S6 K-L plots of various catalysts: (a) CPVFe-900; (b) CPVFe-S-600; (c) CPVFe-S-750; (d) CPVFe-S-900.

References:

1. A. Vinu, *Adv Funct Mater*, 2008, **18**, 816-827.

2. Y. Zheng, Y. Jiao, J. Chen, J. Liu, J. Liang, A. Du, W. M. Zhang, Z. H. Zhu, S. C. Smith, M. Jaroniec, G. Q. Lu and S. Z. Qiao, *J Am Chem Soc*, 2011, **133**, 20116-20119.