Ultrasonic-assisted-microwave quick synthesis of Pd nanoparticles on N-doped porous carbon for efficient direct hydrogen peroxide synthesis from hydrogen and oxygen at atmospheric pressure

Yongyong Shiab, Donghai Jiangac, Liming Zhouac, Jingyun Zhaoab, Jun Maab,

Qian Lin\*ab, Hongyan Pan\*ab

\* Corresponding authors

a College of Chemistry and Chemical Engineering, Guizhou University, Guiyang, Guizhou 550025, China

b Guizhou Key Laboratory of Green Chemical and Clean Energy Technology, Guiyang, Guizhou 550025, China

c College of Chemical Engineering, Guizhou Institute of Technology, Guiyang 550003, China

E-mail: linq@gzu.edu.cn, hypan@gzu.edu.cn

|  |
| --- |
| 新-不同合成方法制备-Pd-NPCS催化剂的XRD谱图 |
| Fig. S1. XRD patterns of Pd/NPCS(Y) catalysts prepared by different synthesis methods |

|  |
| --- |
| NPCS氮掺杂多孔碳载体Raman谱图 |
| Fig. S2. Raman spectra of NPCS support |

Table S1 Elemental analysis and XPS analysis of NPCS support

|  |  |  |
| --- | --- | --- |
| Samplename | Elemental analysis | XPS |
| Ca(wt%) | Na(wt%) | Ha(wt%) | Ob(wt%) | Cc(wt%) | Nc(wt%) | Oc(wt%) |
| NPCS | 92.50 | 1.18 | 0.46 | 5.86 | 95.45 | 0.74 | 3.81 |

\*a Obtained by elemental analyzer

\*bCalculated by the difference method

\*c Obtained by XPS

|  |
| --- |
| D:\N掺杂多孔碳负载Pd催化剂小论文\NPCS氮掺杂多孔碳载体XPS汇总.tif**(d)****(c)****(b)****(a)** |
| Fig. S3. XPS spectra of NPCS (a) XPS survey (b-d) C1s、O1s and N1s XPS spectra |

|  |
| --- |
| D:\N掺杂多孔碳负载Pd催化剂小论文\NPCS氮掺杂多孔碳载体FT-IR谱图.tif |
| Fig. S4. FT-IR spectra of NPCS support |
|  |
| Fig. S5. XRD patterns of Pd/NPCS(W) catalysts prepared by different temperature |

|  |
| --- |
|  |
| Fig. S6. Pd3d spectra of Pd0.3/NPCS(W) catalyst after reaction 3 hours |

|  |
| --- |
|  |
| Fig. S7. XRD patterns of Pd0.3/NPCS(W) catalyst after reaction 3 hours |

Table S2 Pd3d XPS spectra quantitative analysis of Pd0.3/NPCS(W) catalyst after reaction 3 hours

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Catalysts | Pd | Pd3d3/2 (eV) | Pd3d5/2 (eV) | Pd0(at%)b | Pd2+(at%)b | Pd0/Pd2+ |
| (wt%)a | Pd0 | Pd2+ | Pd0 | Pd2+ |
| Pd0.3/NPCS(W) | 2.48 | 340.86 | 341.95 | 335.60 | 336.80 | 50.15 | 49.85 | 1.00 |

a Derived from ICP-MS.

b Derived from XPS.