Data set for

In situ determination of the nanostructure effects on the activity, stability and selectivity of Pt-Sn ethanol oxidation catalysts

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<https://doi.org/10.1016/j.jelechem.2017.09.060>

Figure 1. HAAF and STEM-EDS spectra

(a) and (b) EDS HAADF-Sn\_Pt 2NPs.tif

(c) and (d) EDS HAADF- Pt3Sn.tif

Figure 2.

(a) Pt1Sn1/C XRD P1Sn1.txt; Pt3Sn/C XRD Pt3Sn1.txt; Sn/Pt/C XRD Sn\_Pt.txt; Pt/C-JM XRD Pt-JM.txt

(b) Pt1Sn1/C XPS-Pt4f Pt1Sn1 fresh.txt and XPS-Sn3d Pt1Sn1 fresh.txt; Pt3Sn/C XPS-Pt4f Pt3Sn1 fresh.txt and XPS-Sn3d Pt3Sn1 fresh.txt; Sn/Pt/C XPS-Pt4f Sn\_Pt fresh.txt and XPS-Sn3d Sn\_Pt fresh.txt; Pt/C-JM XPS-Pt4f Pt-JM fresh.txt

Table 1 and figures S4, S5 and S6. EXAFS data at potentials indicated for Sn/Pt/C

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Edge | Electrolyte | 0.2 V | 0.4 V | 0.6 V |
| Pt L3 | 0.5 M H2SO4 | EXAFS-PtL3\_Sn\_Pt\_0.2V\_acid.dat | EXAFS-PtL3\_Sn\_Pt\_0.4V\_acid.dat | EXAFS-PtL3\_Sn\_Pt\_0.6V\_acid.dat |
| Pt L3 | 0.5 M H2SO4 + 0.5 M Ethanol | EXAFS-PtL3\_Sn\_Pt\_0.2V\_EtOH.dat | EXAFS-PtL3\_Sn\_Pt\_0.4V\_EtOH.dat | EXAFS-PtL3\_Sn\_Pt\_0.6V\_EtOH.dat |
| Sn K | 0.5 M H2SO4  | EXAFS-SnK-Sn\_Pt\_0.2V\_acid.dat | EXAFS-SnK-Sn\_Pt\_0.4V\_acid.dat | EXAFS-SnK-Sn\_Pt\_0.6V\_acid.dat |
| Sn K | 0.5 M H2SO4 + 0.5 M Ethanol | EXAFS-SnK-Sn\_Pt\_0.2V\_EtOH.dat | EXAFS-SnK-Sn\_Pt\_0.4V\_EtOH.dat | EXAFS-SnK-Sn\_Pt\_0.6V\_EtOH.dat |

Table 2 and figures S4, S5 and S6. EXAFS data at potentials indicated for Pt3Sn1/C

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Edge | Electrolyte | 0.2 V | 0.4 V | 0.6 V |
| Pt L3 | 0.5 M H2SO4 | EXAFS-PtL3\_Pt3Sn1\_0.2V\_acid.dat | EXAFS-PtL3\_Pt3Sn1\_0.4V\_acid.dat | EXAFS-PtL3\_Pt3Sn1\_0.6V\_acid.dat |
| Pt L3 | 0.5 M H2SO4 + 0.5 M Ethanol | EXAFS-PtL3\_ Pt3Sn1\_0.2V\_EtOH.dat | EXAFS-PtL3\_Pt3Sn1\_0.4V\_EtOH.dat | EXAFS-PtL3\_Pt3Sn1\_0.6V\_EtOH.dat |
| Sn K | 0.5 M H2SO4  | EXAFS-SnK\_Pt3Sn1\_0.2V\_acid.dat | EXAFS-SnK\_Pt3Sn1\_0.4V\_acid.dat | EXAFS-SnK\_Pt3Sn1\_0.6V\_acid.dat |
| Sn K | 0.5 M H2SO4 + 0.5 M Ethanol | EXAFS-SnK\_Pt3Sn1\_0.2V\_EtOH.dat | EXAFS-SnK\_Pt3Sn1\_0.4V\_EtOH.dat | EXAFS-SnK\_Pt3Sn1\_0.6V\_EtOH.dat |

Figure 3. Cyclic voltammograms

Pt/C-JM CV EtOH Pt-JM.txt

Pt1Sn1/C CV EtOH Pt1Sn1.txt

Pt3Sn1/C CV EtOH Pt3Sn1.txt

Sn/Pt/C CV EtOH Sn\_Pt.txt

Figure 4. FTIR data

Pt/C-JM FTIR Pt-JM

Pt1Sn1/C FTIR Pt1Sn1.txt

Pt3Sn1/C FTIR-Pt3Sn1.txt

Sn/Pt/C FTIR-Sn\_Pt.txt

Table 3. EXAFS data for aged samples at 0.2 V in 0.5 M H2SO4

|  |  |  |
| --- | --- | --- |
| Sample | Edge | Filename |
| Pt/C-JM | Pt L3 | EXAFS-PtL3-cycled\_Pt\_JM\_0.2V.dat |
| Sn/Pt/C  | Pt L3 | EXAFS-PtL3-cycled\_Pt3Sn1\_0.2V.dat |
| Sn/Pt/C  | Sn K | EXAFS-SnK-cycled\_Sn\_Pt\_0.2V.dat |
| Pt3Sn1/C  | Pt L3 | EXAFS-PtL3-cycled\_Sn\_Pt\_0.2V.dat |
| Pt3Sn1/C  | Sn K | EXAFS-SnK-cycled\_Pt3Sn1\_0.2V.dat |

S1. TEM images

1. Sn/Pt/C TEM Sn\_Pt low magnification.jpg
2. Pt3Sn1/C TEM Pt3Sn1 low magnification.jpg
3. Pt1Sn1/C TEM Pt1Sn1 low magnification.jpg

Table S3 and figures S2 and S3. Ex situ EXAFS data

|  |  |  |
| --- | --- | --- |
| Sample | Edge | Filename |
| Pt/C-JM | Pt L3 | EXAFS-PtL3-Pt-JM ex situ.nor |
| Sn/Pt/C  | Pt L3 | EXAFS-PtL3-Sn\_Pt ex situ.nor |
| Sn/Pt/C  | Sn K | EXAFS-SnK-Sn\_Pt ex situ.nor |
| Pt3Sn1/C  | Pt L3 | EXAFS-PtL3-Pt3Sn1 ex situ.nor |
| Pt3Sn1/C  | Sn K | EXAFS-SnK-Pt3Sn1 ex situ.nor |
| Pt1Sn1/C  | Pt L3 | EXAFS-PtL3-Pt1Sn1 ex situ.nor |
| Pt1Sn1/C  | Sn K | EXAFS-SnK-Pt1Sn1 ex situ.nor |
| Pt foil | Pt L3 | EXAFS-PtL3-Pt\_foil.nor |
| Sn foil | Sn K | EXAFS-SnK-Sn\_foil.nor |
| SnO2 | Sn K | EXAFS-SnK-SO2.nor |

Table S4 and Figures S4 and S6. EXAFS data at potentials indicated for Pt/C-JM

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Edge | Electrolyte | 0.2 V | 0.4 V | 0.6 V |
| Pt L3 | 0.5 M H2SO4 | EXAFS-PtL3\_Pt-JM\_0.2V\_acid.dat | EXAFS-PtL3\_Pt-JM 0.4V\_acid.dat | EXAFS-PtL3\_Pt-JM 0.6V\_acid.dat |
| Pt L3 | 0.5 M H2SO4 + 0.5 M Ethanol | EXAFS-PtL3\_Pt-JM 0.2V\_EtOH.dat | EXAFS-PtL3\_Pt-JM 0.4V\_EtOH.dat | EXAFS-PtL3\_Pt-JM 0.6V\_EtOH.dat |

Figure S7. EXAFS data obtained at 0.2 V after aging

|  |  |  |
| --- | --- | --- |
| Sample | Edge | Filename |
| Pt/C-JM | Pt L3 | EXAFS-PtL3-cycled\_Pt\_JM\_0.2V.dat |
| Sn/Pt/C  | Pt L3 | EXAFS-PtL3-cycled\_Sn\_Pt\_0.2V.dat |
| Sn/Pt/C  | Sn K | EXAFS-SnK-cycled\_Sn\_Pt\_0.2V.dat |
| Pt3Sn1/C  | Pt L3 | EXAFS-PtL3-cycled\_Pt3Sn1\_0.2V.dat |
| Pt3Sn1/C  | Sn K | EXAFS-SnK-cycled\_Pt3Sn1\_0.2V.dat |

Figure S8. CO Stripping CVs

Pt/C-JM CO-stripping Pt-JM.txt

Pt3Sn1/C CO-stripping Pt3Sn1.txt

Pt1Sn1/C CO-stripping Pt1Sn1.txt

Sn/Pt/C CO-stripping Sn\_Pt.txt

Figure S9.

(a), (d), and (g) CV in 0.5 M H2SO4

Pt/C-JM Stability-CV Pt-JM.txt

Pt3Sn1/C Stability-CV Pt3Sn1.txt

Sn/Pt/C Stability-CV - Sn\_Pt.txt

(b), (e), and (h) CO stripping CV

Pt/C-JM Stability-CO Pt-JM.txt

Pt3Sn1/C Stability-CO Pt3Sn1.txt

Sn/Pt/C Stability-CO - Sn\_Pt.txt

(c), (f), and (i) Ethanol oxidation CV

Pt/C-JM Stability-EtOH Pt-JM.txt

Pt3Sn1/C Stability-EtOH Pt3Sn1.txt

Sn/Pt/C Stability-EtOH - Sn\_Pt.txt