

**Multisource Synergistic Electrocatalytic Oxidation Effect of Strongly
Coupled PdM (M=Sn, Pb) /N-doped Graphene Nanocomposite on
Small Organic Molecules**

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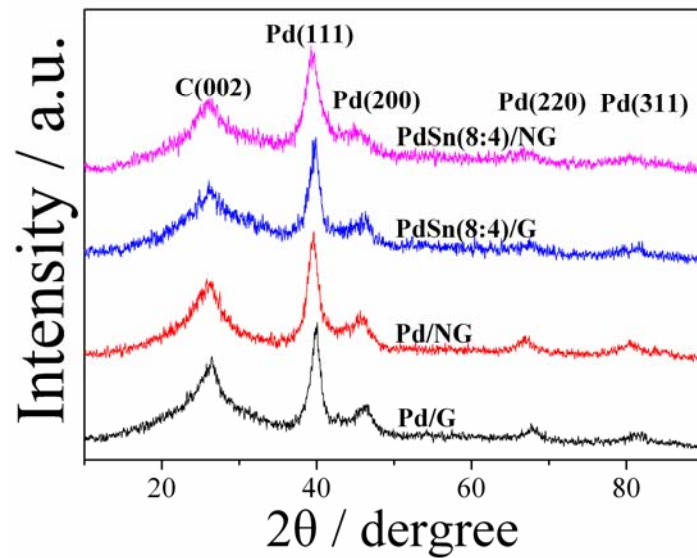


Figure S1. XRD patterns of Pd/G, Pd/NG, PdSn(8:4)/NG and PdSn(8:4)/G.

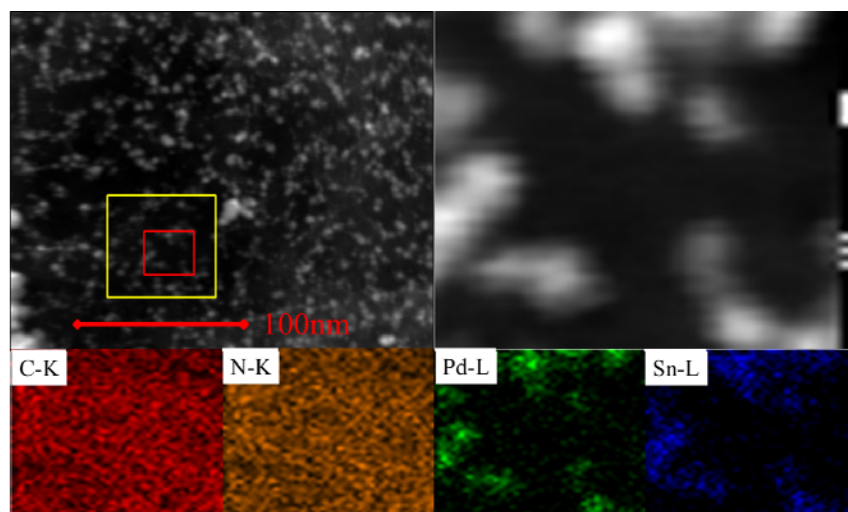


Figure S2. EELS mappings of the PdSn/NG sample showing the distributions of C, N, Pd and Sn.

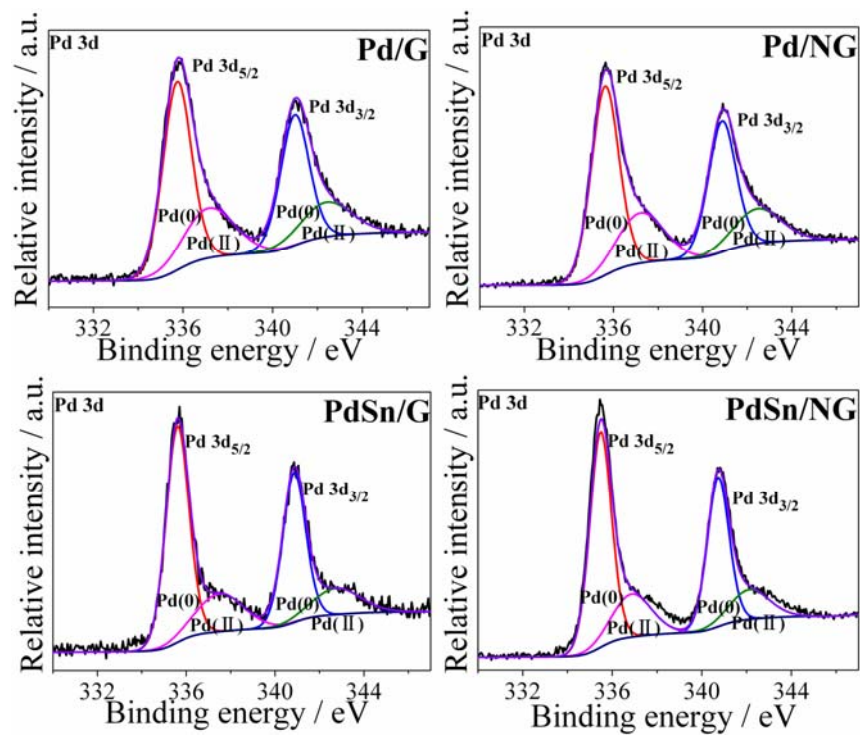


Figure S3. XPS spectrum of Pd/G, Pd/NG, PdSn/G and PdSn/NG in Pd 3d region.

Table S1. The ratios between bivalent species and metallic Pd.

<i>BEs/eV</i>	<i>Pd3d_{5/2}</i> <i>[Pd(II):Pd(0)]</i> <i>ratio</i>	<i>Pd3d_{3/2}</i> <i>[Pd(II):Pd(0)]</i> <i>ratio</i>
<i>Pd/G</i>	0.54:1	0.54:1
<i>Pd/NG</i>	0.49:1	0.50:1
<i>PdSn/G</i>	0.40:1	0.43:1
<i>PdSn/NG</i>	0.40:1	0.41:1

Table S2. The peak of XPS spectrum in Pd 3d region

<i>BEs/eV</i>	<i>Pd3d_{5/2}</i>	<i>Pd3d_{3/2}</i>
<i>Pd/G</i>	335.8	341.0
<i>Pd/NG</i>	335.7	340.9
<i>PdSn/G</i>	335.7	340.8
<i>PdSn/NG</i>	335.5	340.7

Table S3. The peak of XPS spectrum in Sn 3d region

<i>BEs/eV</i>	<i>Sn3d_{5/2}</i>	<i>Sn3d_{3/2}</i>
<i>PdSn/G</i>	486.6	495.1
<i>PdSn/NG</i>	487.0	495.4

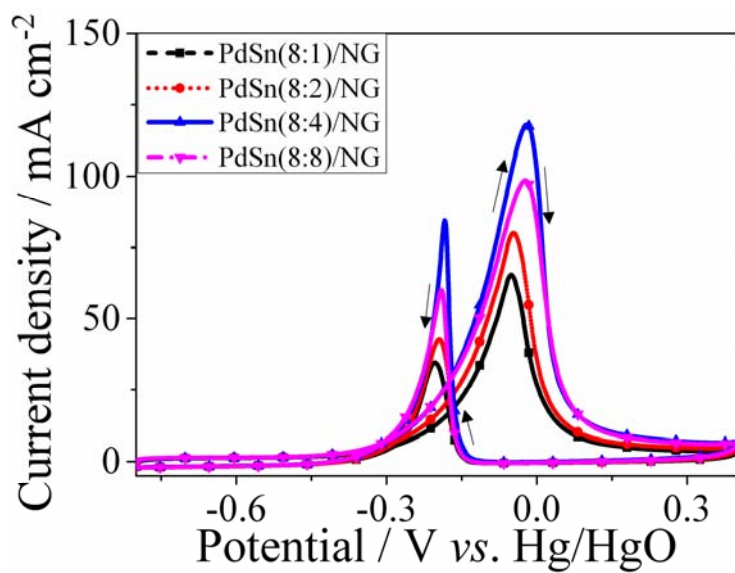


Figure S4. Cyclic voltammograms of PdSn/NG with different Pd/Sn atomic ratios catalysts in the 1 M KOH + 0.5 M (CH₂OH)₂ solution. Scan rate: 50 mV s⁻¹.

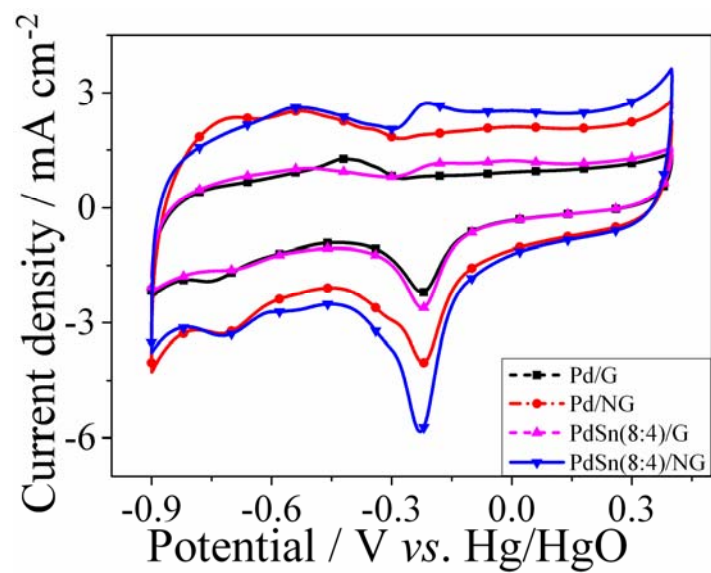


Figure S5. Cyclic voltammograms of Pd/G, Pd/NG, PdSn(2:1)/G and PdSn(2:1)/NG in the 1 M KOH solution. Scan rate: 50 mV s⁻¹.

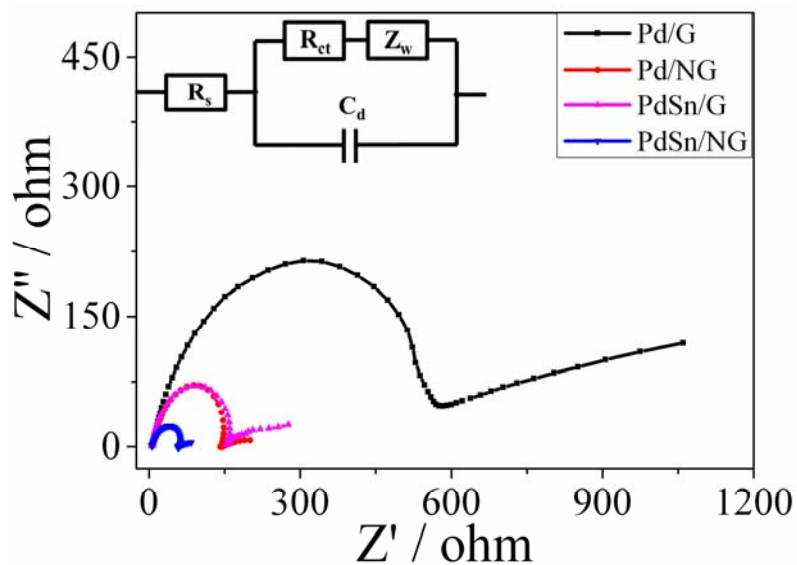


Figure S6. Electrochemical impedance spectra in 1 M KOH + 0.5 M $(\text{CH}_2\text{OH})_2$ solution at -0.15 V. The amplitude of the modulation potential is 5 mV. The frequency ranged from 100 kHz to 100 mHz and the equivalent circuit used to fit the impedance spectra.

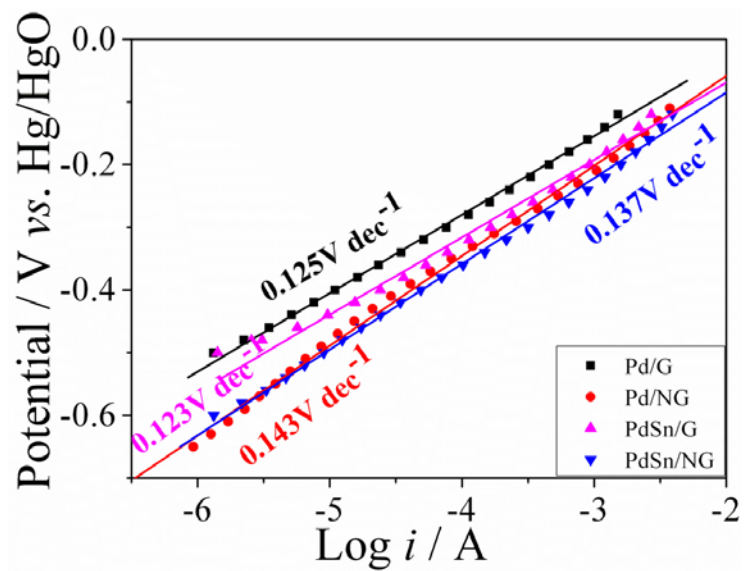


Figure S7. Tafel plots of the as-prepared catalysts were performed at the scan rate of 2 mV s^{-1} in $1 \text{ M KOH} + 0.5 \text{ M (CH}_2\text{OH)}_2$ solution.

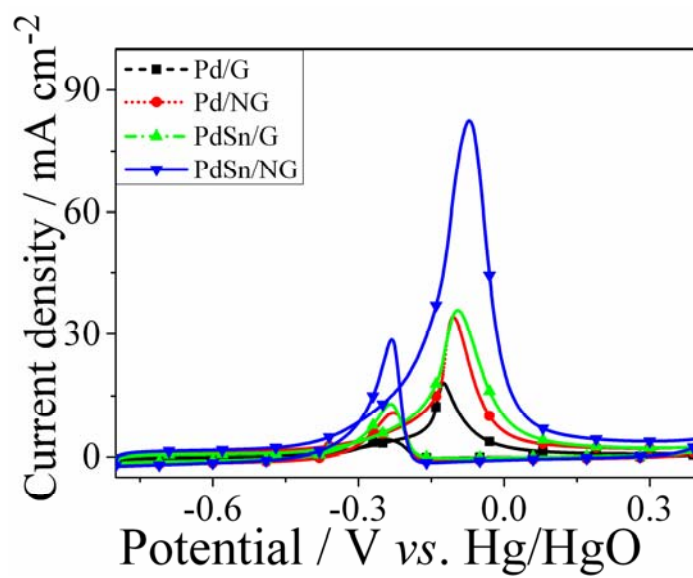


Figure S8. Cyclic voltammograms of Pd/G, Pd/NG, PdSn/G and PdSn/NG in the 1 M KOH + 0.5 M CH₃OH solution. Scan rate: 50 mV s⁻¹.

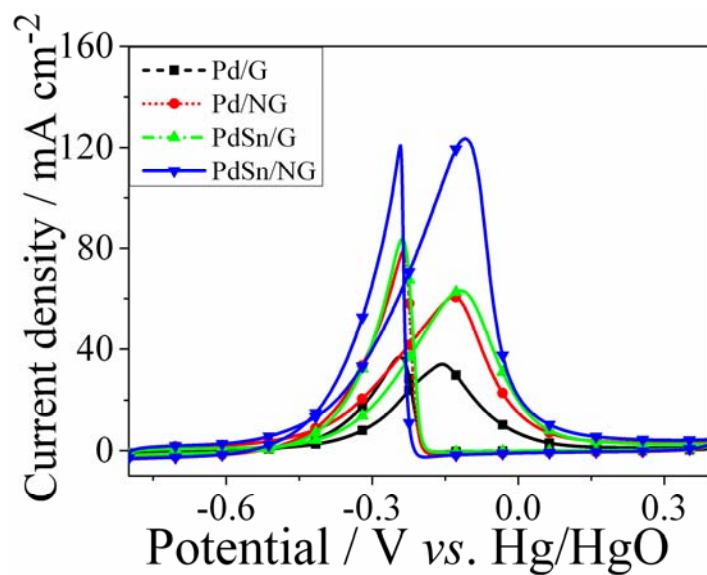


Figure S9. Cyclic voltammograms of Pd/G, Pd/NG, PdSn/G and PdSn/NG in the 1 M KOH + 0.5 M C₂H₅OH solution. Scan rate: 50 mV s⁻¹.

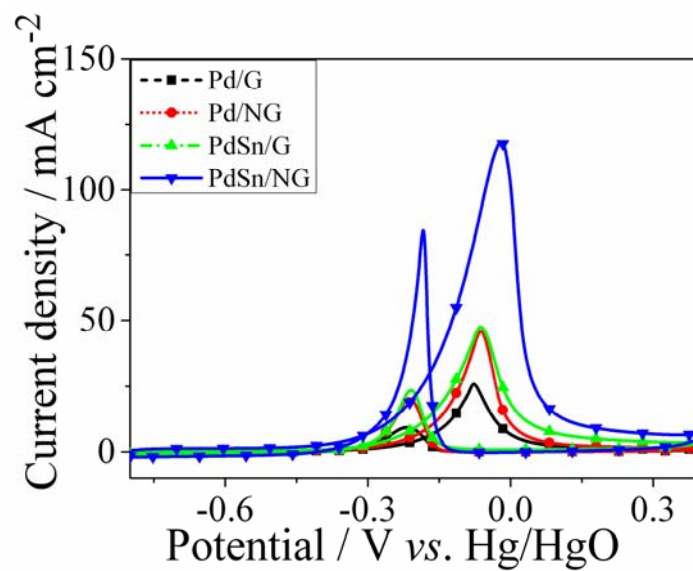


Figure S10. Cyclic voltammograms of Pd/G, Pd/NG, PdSn/G and PdSn/NG in the 1 M KOH + 0.5 M (CH₂OH)₂ solution. Scan rate: 50 mV s⁻¹.

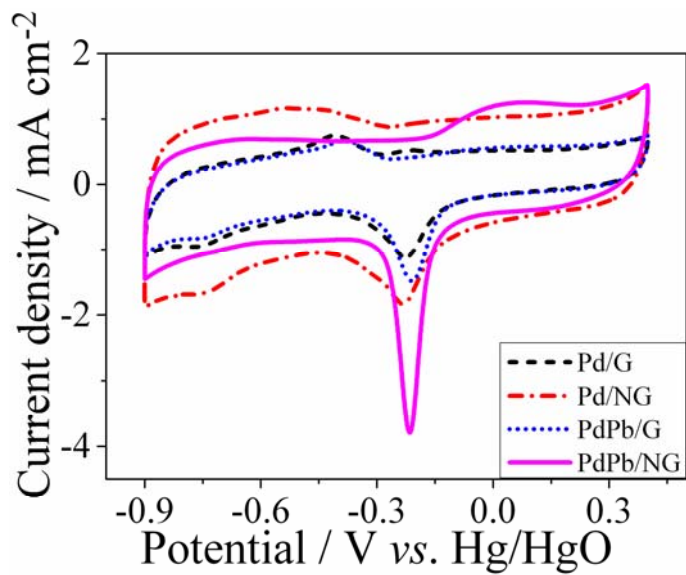


Figure S11. Cyclic voltammograms of Pd/G, Pd/NG, PdPb(2:1)/G and PdPb(2:1)/NG in the 1 M KOH solution. Scan rate: 50 mV s⁻¹.

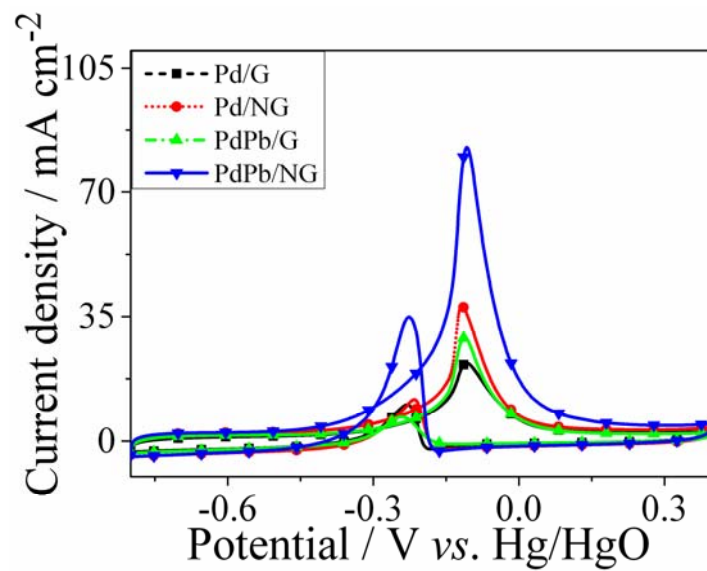


Figure S12. Cyclic voltammograms of Pd/G, Pd/NG, PdPb/G and PdPb/NG in the 1 M KOH + 0.5 M CH₃OH solution. Scan rate: 50 mV s⁻¹.

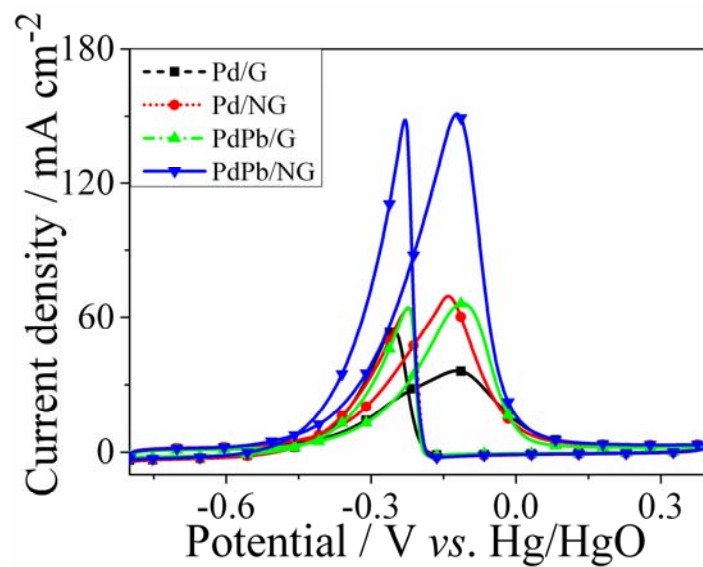


Figure S13. Cyclic voltammograms of Pd/G, Pd/NG, PdPb/G and PdPb/NG in the 1 M KOH + 0.5 M C₂H₅OH solution. Scan rate: 50 mV s⁻¹.

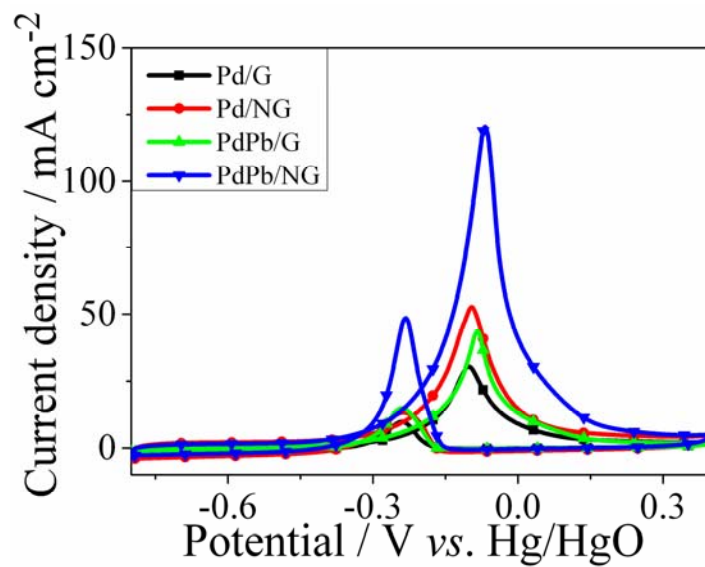


Figure S14. Cyclic voltammograms of Pd/G, Pd/NG, PdPb/G and PdPb/NG in the 1 M KOH + 0.5 M (CH₂OH)₂ solution. Scan rate: 50 mV s⁻¹.