

Supporting information

Nano-sized NiO immobilized on Au/CNT for benzyl alcohol oxidation:

Influences of hybrid structure and interface

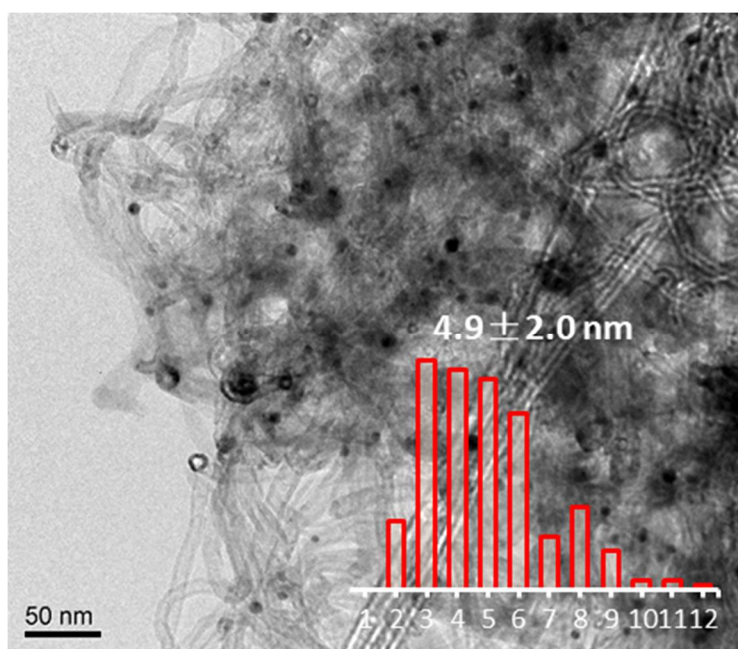
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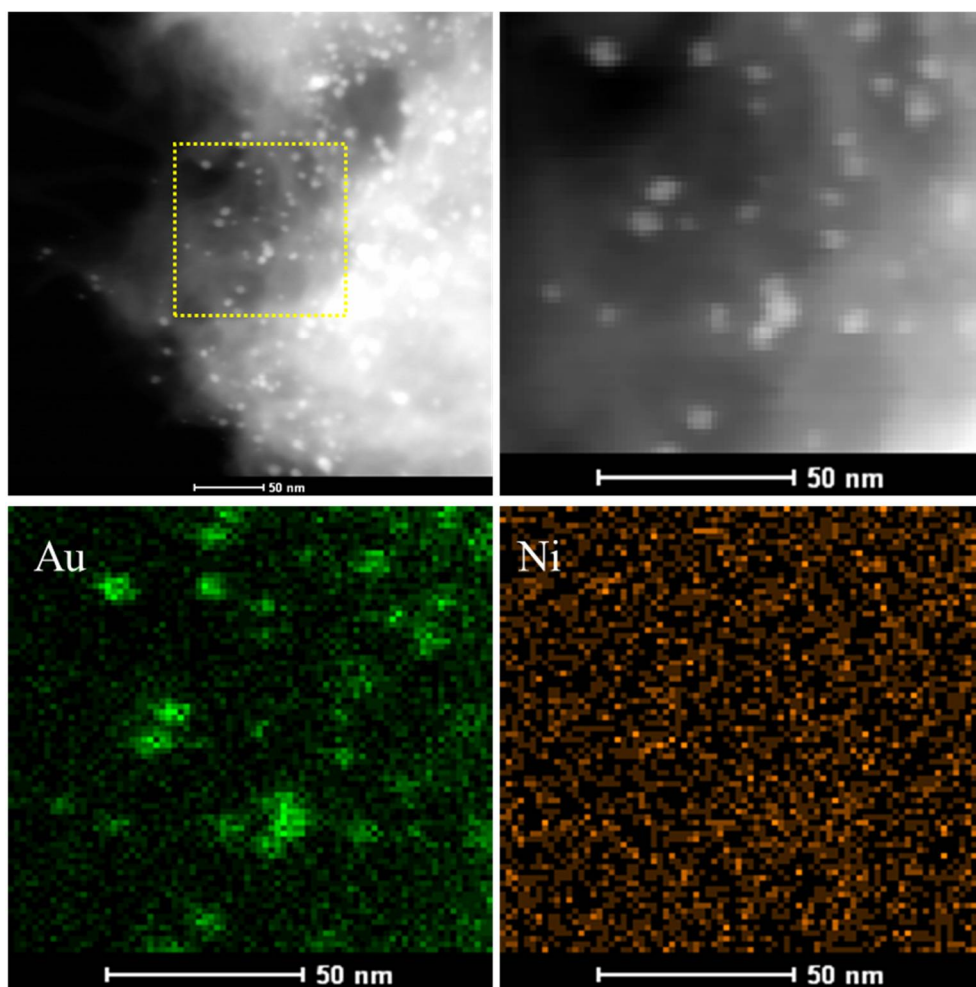
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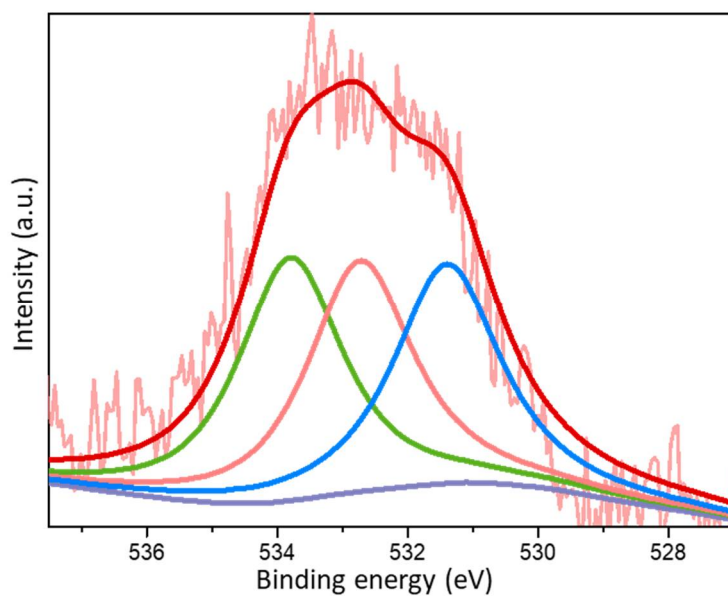
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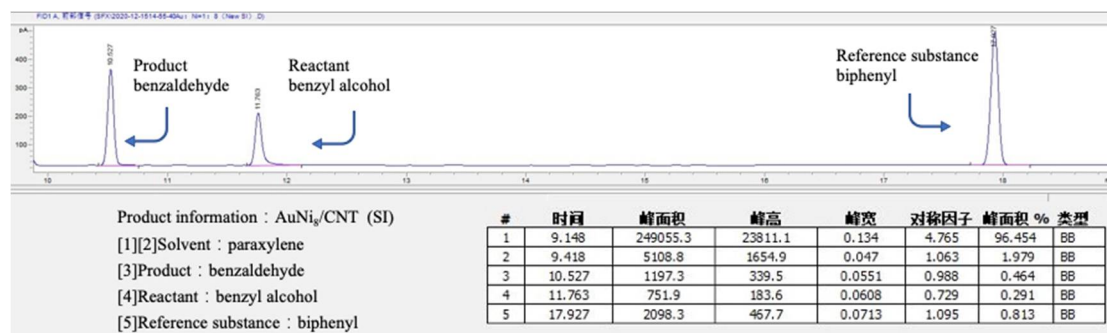
**Figure S1.** TEM image and size distribution of Au/CNT catalyst.



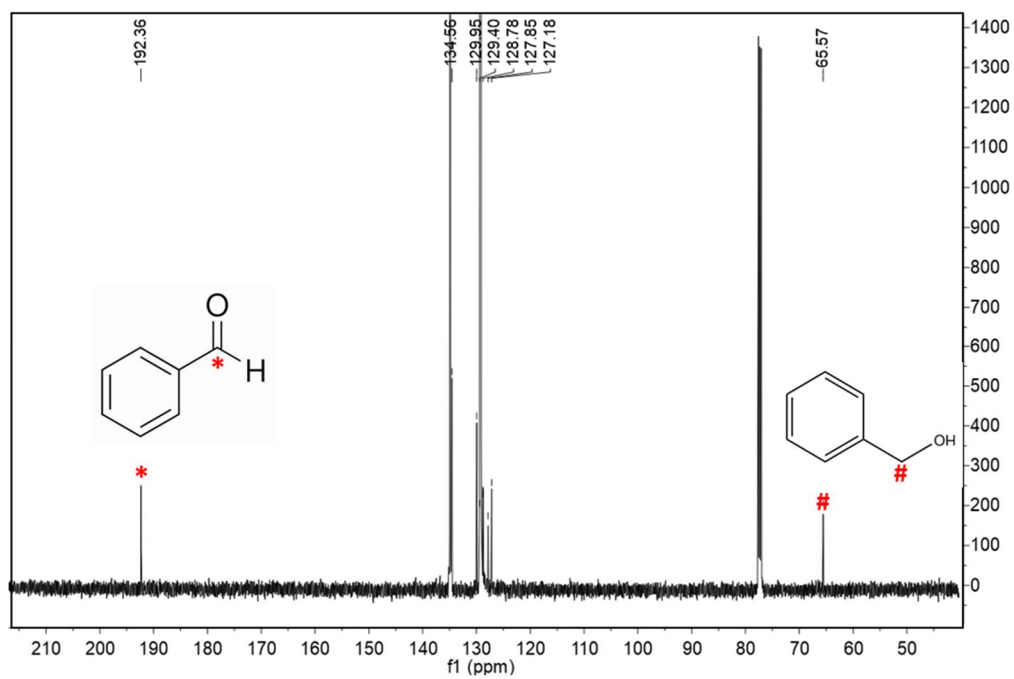
**Figure S2.** HAADF-STEM element mappings of the AuNi<sub>8</sub>/CNT catalyst.



**Figure S3.** XPS spectra of the O 1s (c) core level of Au/CNT reference sample.



**Figure S4.** A typical GC analysis graph by Au reflecting the chromatographic peaks of benzaldehyde, benzyl alcohol, and biphenyl (substance) in the reaction mixture.



**Figure S5.**  $^{13}\text{C}$  NMR spectra of typical reaction mixture.

**Table S1** Surface composition of different gold catalysts.

| Catalyst                | Au 4 <i>f</i>       |                      | Ni 2 <i>p</i>       |                      | Au/C% <sup>a</sup> | Ni/Au <sup>b</sup> |
|-------------------------|---------------------|----------------------|---------------------|----------------------|--------------------|--------------------|
|                         | Au <sup>0</sup> (%) | Au <sup>δ+</sup> (%) | Ni <sup>0</sup> (%) | Ni <sup>2+</sup> (%) |                    |                    |
| Au/CNT                  | 100                 | 0                    | n.a.                | n.a.                 | 3.1                | n.a.               |
| AuNi <sub>2</sub> /CNT  | 100                 | 0                    | n.a.                | n.a.                 | 2.9                | n.a.               |
| AuNi <sub>8</sub> /CNT  | 90.1                | 9.9                  | 17.4                | 82.6                 | 3.4                | 11.2               |
| AuNi <sub>12</sub> /CNT | 86.1                | 13.9                 | 0                   | 100                  | 3.3                | 14.8               |

<sup>a</sup> Surface weight ratio of Au/C by XPS results.

<sup>b</sup> Surface atomic ratio of Ni/Au by XPS results.

**Table S2** Comparison of specific rate in the current work and the reported literature

| Catalyst                    | Reaction temperature | Specific rate ( $\mu\text{mol/g/s}$ ) | Literature |
|-----------------------------|----------------------|---------------------------------------|------------|
| Au/CNT                      | 50 °C                | 163                                   | This work  |
| AuNi <sub>8</sub> /CNT      | 50 °C                | 185                                   | This work  |
| AuNi <sub>12</sub> /CNT     | 50 °C                | 208                                   | This work  |
| AuNi <sub>16</sub> /CNT     | 50 °C                | 182                                   | This work  |
| 0.5Au-CeZr                  | 100 °C               | 370                                   | [1]        |
| RMC-Au                      | 130 °C               | 212                                   | [2]        |
| Au/CZ                       | 80 °C                | 106                                   | [3]        |
| Au-Pd/TiO <sub>2</sub>      | 90 °C                | 1239                                  | [4]        |
| Au-Pd/TiO <sub>2</sub> -001 | 120 °C               | 26002                                 | [5]        |

### References

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