Supporting information

Low-temperature selective catalytic reduction of NO\textsubscript{x} with NH\textsubscript{3} over activated carbon-carbon nanotubes composite material prepared by \textit{in-situ} method

Pengchen Wang,\textsuperscript{a} Lu Yao,\textsuperscript{a,b,*} Yijuan Pu,\textsuperscript{a} Lin Yang,\textsuperscript{a,b} Xia Jiang,\textsuperscript{a,b} Wenju Jiang\textsuperscript{a,b,*}

\textsuperscript{a} College of Architecture and Environment, Sichuan University, Chengdu 610065, P.R. China

\textsuperscript{b} National Engineering Research Center for Flue Gas Desulfurization, Chengdu 610065, P.R. China

*Corresponding author. E-mail: yaolu@scu.edu.cn (L. Yao); wenjujiang@scu.edu.cn (W. Jiang); Tel: +86-28-8540 7800; Fax: +86-28-8540 5613

Figures

![Fig. S1. N\textsubscript{2} adsorption-desorption isotherms of prepared samples.](image)

The XRD patterns of AC, AC-CNTs Ce/AC and Ce/AC-CNTs were exhibited in Fig. S2. The wide diffraction peaks locating at 20-30 ° of graphite (002) were reflected the existence of graphite crystallite with layered structure (JCPDS 26-1079). The typical peaks of Ce/AC and Ce/AC-CNTs at
$2\theta = 28.6^\circ$, $47.5^\circ$ and $56.3^\circ$ corresponded to CeO$_2$ (JCPDS 34-0394).  

Fig. S2. XRD patterns AC, AC-CNTs, Ce/AC and Ce/AC-CNTs. 

Fig. S3. NH$_3$-TPD profiles of Ce/AC and Ce/AC-CNTs.
The Ce 3d spectra (Fig. S5) of Ce/AC and Ce/AC-CNTs can be separated into eight well-resolved bands, which could be classified into two groups of spin-orbital multiplets, denoted as “u” and “v”, respectively. The u′ bands are resulted from Ce$^{3+}$ ions, while the v′ bands are related to Ce$^{4+}$ ions, revealing the coexistence of Ce$^{3+}$ and Ce$^{4+}$ states in catalysts.
Fig. S6. SO₂ tolerance and water−resistance of Ce/AC over time.

Fig. S7. SO₂ tolerance and water−resistance of Ce/AC-CNTs over time.

### Tables

**Table S1** Concentration of Ni found in bulk (by ICP) and surface (by XPS) of catalysts.

<table>
<thead>
<tr>
<th>sample</th>
<th>ICP (%)</th>
<th>XPS (%)</th>
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<tbody>
<tr>
<td>AC-CNTs</td>
<td>9.25</td>
<td>0.81</td>
</tr>
<tr>
<td>Ce/AC-CNTs</td>
<td>9.28</td>
<td>0.88</td>
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</tbody>
</table>

### Reference