Supporting Information

Title: Removal of gaseous elemental mercury by cylindrical activated coke loaded with CoO$_x$-CeO$_2$ from simulated coal combustion flue gas

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The supporting information includes 3 pages, and 1 table.

Mercury Speciation Conversion System

To further identify the mercury speciation in the outlet flue gas, a mercury speciation conversion system coupled with RA-915M mercury analyzer was employed to measure Hg^0 and Hg^{2+} concentrations in the outlet flue gas when it necessary (conditional unit). As shown in the Fig. 1, in the mercury conversion system, gas stream released from the reactor was divided into two streams, one for measuring total mercury (Hg^T) and the other for elemental mercury (Hg^0). On one stream, an impinger with 10 wt% acidic stannous chloride ($SnCl_2$) solution was used to measure Hg^T, since acidic $SnCl_2$ solution can reduce Hg^{2+} to Hg^0 which can then be detected by the mercury analyzer. On the other stream, an impinger containing 10 wt% potassium chloride (KCl) solution was used to measure Hg^0, because KCl solution can capture Hg^{2+} and allow only Hg^0 to pass through. Before the sampling gas entered the $SnCl_2$ solution, a 10% sodium hydroxide (NaOH) solution was used to remove SO_2. The concentration of Hg^{2+} in outlet flue gas could then be calculated by the difference between Hg^T and Hg^0. At the end of the conversion system, the two streams converged to a 10% NaOH solution in which acid gases such as HCl and SO_2 were captured to avoid corrosion of the detection cell in the mercury analyzer.

The Hg^0 capture efficiency (E_{cap}) can be defined as:

$$E_{cap}(\%) = \frac{Hg^0_{in} - Hg^T_{out}}{Hg^0_{in}} \qquad (S1)$$

where Hg^0_{in} represent Hg^0 concentration in inlet of the reactor, and Hg^T_{out} represent Hg^T concentration in outlet of the reactor.

Table S1. The Hg^0 removal/ capture efficiency of $Co_{4.5}Ce_6/AC$.

time (h)	inlet Hg^0 ($\mu g/m^3$)	outlet Hg^T ($\mu g/m^3$)	outlet Hg^0 ($\mu g/m^3$)	E_{rem}(%)	E_{cap}(%)
1	105.32	13.65	7.58	92.8	87.0
2	105.58	13.96	7.81	92.6	86.8
3	104.97	13.32	7.53	92.8	87.3

Mechanism of Hg^0 removal by cylindrical activated coke loaded with CoO$_x$-CeO$_2$.