Supporting Information

Outstanding performance of magnetically separable sulfureted MoO_3/Fe-Ti spinel for gaseous Hg^0 recovery from smelting flue gas: Mechanism and adsorption kinetics

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Content including: eight pages, one table and five figures.

1. XRD and BET

X-ray diffraction (XRD) patterns and Brunauer–Emmett–Teller (BET) surface areas were measured using an AXS D8 Advance X-ray diffractometer of Bruker and an Autosorb-1 nitrogen adsorption apparatus of Quantachrome, respectively.

Fe-Ti spinel's XRD pattern corresponded well to γ-Fe_2O_3 (JCPDS: 39-1346), and there were hardly any other peaks assigned to other iron oxides and TiO_2 (Figure S4). This suggests that the synthetic Fe-Ti spinel presented a spinel structure. After MoO_3 loading, its XRD pattern did not vary, and no peaks corresponding to any molybdenum oxide can be observed. This suggests that the spinel structure was not destroyed and that the molybdenum oxides may be well dispersed on the Fe-Ti spinel. The XRD patterns of the sulfureted MoO_3/Fe-Ti spinel and the sulfureted Fe-Ti spinel were the same as that of the Fe-Ti spinel (Figure S4). This suggests that the spinel structures of both the Fe-Ti spinel and MoO_3/Fe-Ti spinel were hardly destroyed and that the sulfuration reaction may only happen on the surface. Figure S4 also shows that the XRD pattern of the MoO_3/Fe-Ti spinel after five cycles was consistent with the fresh MoO_3/Fe-Ti spinel, suggesting that the magnetic spinel structure was not destroyed after the multiple cycles.

The BET surface areas of the Fe-Ti spinel, MoO_3/Fe-Ti spinel, sulfureted Fe-Ti spinel, and sulfureted MoO_3/Fe-Ti spinel were 47.1, 39.1, 41.2, and 38.7 $m^2\ g^{-1}$, respectively.

Table S1 The average rates of Hg^0 captured by the sulfureted MoO_3/Fe-Ti spinel and sulfureted Fe-Ti spinel in 180 min /μg g^{-1} min^{-1}

	40 °C	60 °C	80 °C	100 °C
sulfureted Fe-Ti spinel	23.9	43.9	48.3	46.7
sulfureted MoO_3/Fe-Ti spinel	87.2	93.3	88.9	78.9
sulfureted MoO_3/Fe-Ti spinel with O_2	85.0	92.2	88.3	78.3
sulfureted MoO_3/Fe-Ti spinel with SO_2 and H_2O	82.8	86.7	78.9	67.8

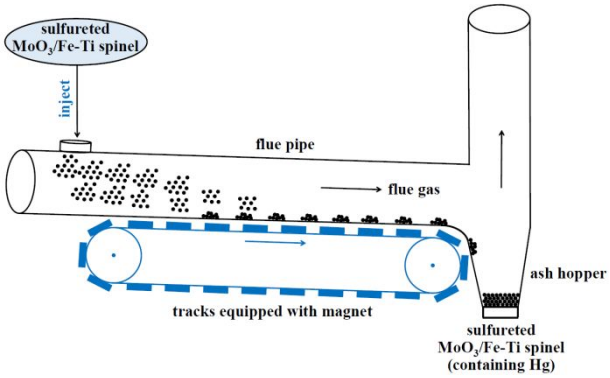
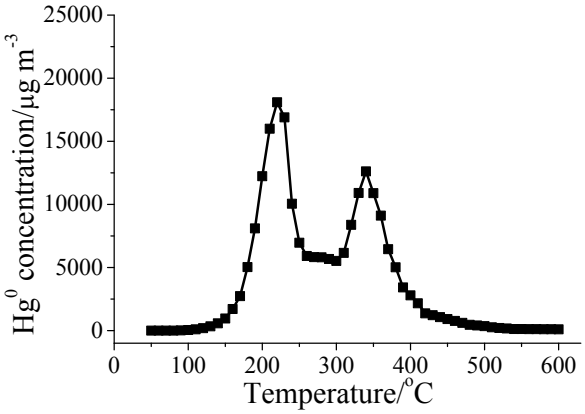
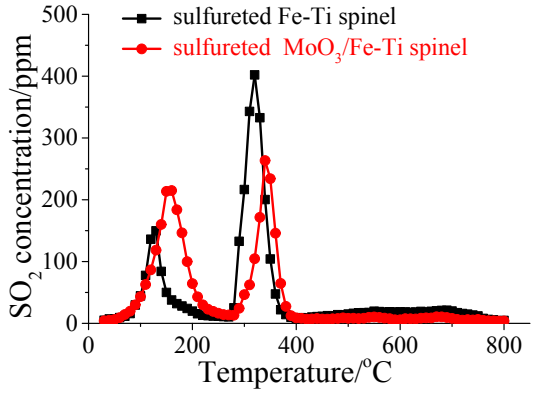


Figure S1 Schematic diagram of magnetic separation of the sulfureted MoO_3/Fe-Ti spinel from smelting flue gas



a



b

Figure S2 (a), Hg-TPD profiles air of the sulfureted MoO_3/Fe-Ti spinel after Hg^0 capture; (b), SO_2-TPO profiles of the sulfureted Fe-Ti spinel and sulfureted MoO_3/Fe-Ti spinel.

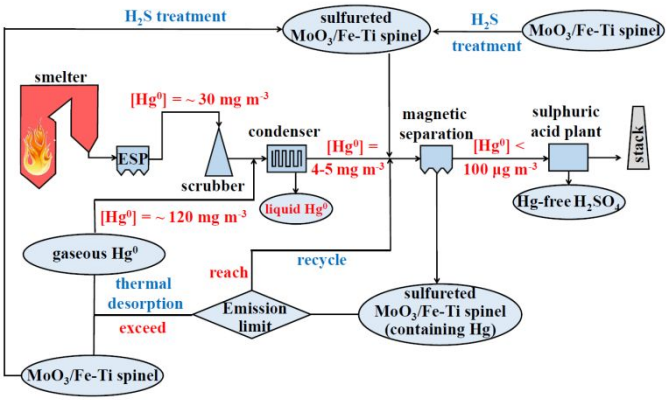


Figure S3 illustration of the recovery of high concentrations of gaseous Hg^0 from smelting flue gas using the magnetic sulfureted MoO_3/Fe-Ti spinel

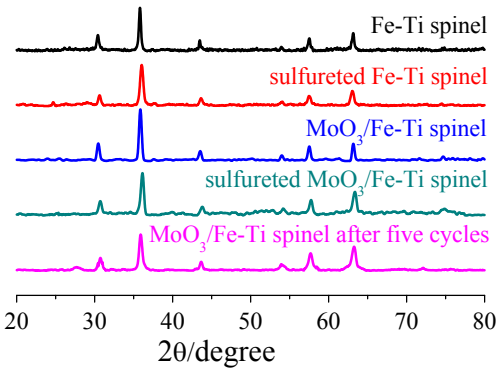
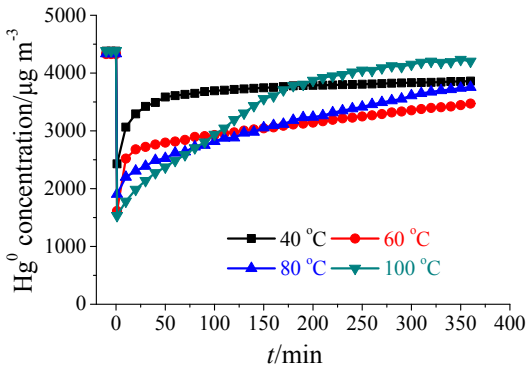


Figure S4 XRD patterns of the Fe-Ti spinel, sulfureted Fe-Ti spinel, MoO_3/Fe-Ti spinel, sulfureted MoO_3/Fe-Ti spinel and MoO_3/Fe-Ti spinel after five cycles.



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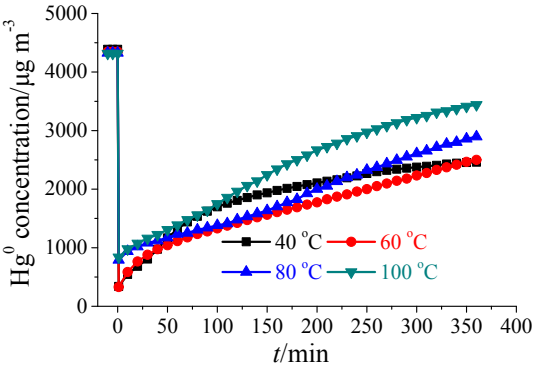

b

Figure S5 Breakthrough curves of gaseous Hg^0 adsorption onto: (a), the sulfureted Fe-Ti spinel; (b), sulfureted MoO_3/Fe-Ti spinel. Reaction conditions: [Hg^0] = 4300 μg m^{-3}, sorbent mass = 10 mg, total flow rate of N_2= 300 mL min^{-1}, and GHSV = 1,800,000 cm^3 g^{-1} h^{-1}.