catalysts

# Supplementary Materials: Performance of Mn-Fe-Ce /GO-x for Catalytic Oxidation of $Hg^0$ and Selective Catalytic Reduction of $NO_x$ in the same temperature range

**Donghai An, Xiaoyang Zhang, Xingxing Cheng *, Yong Dong ***

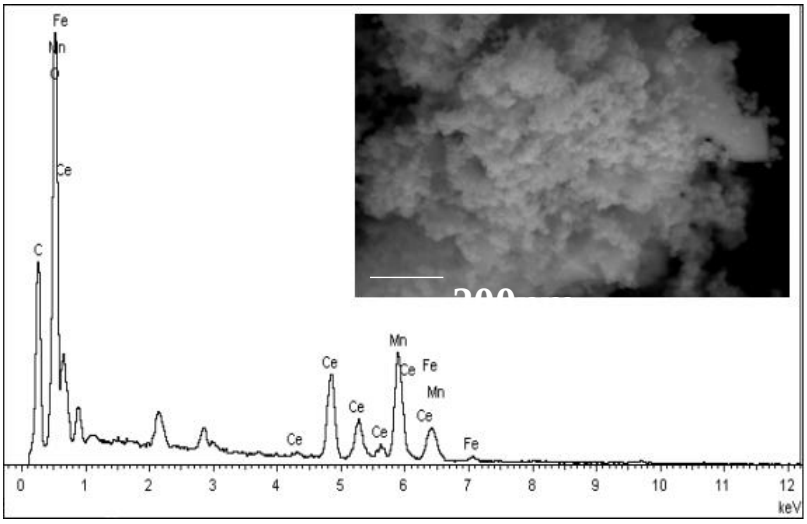


**Figure S1.** The element contents on the surface of graphene (EDS) and SEM images of Ce-Mn-Fe/GO-0.

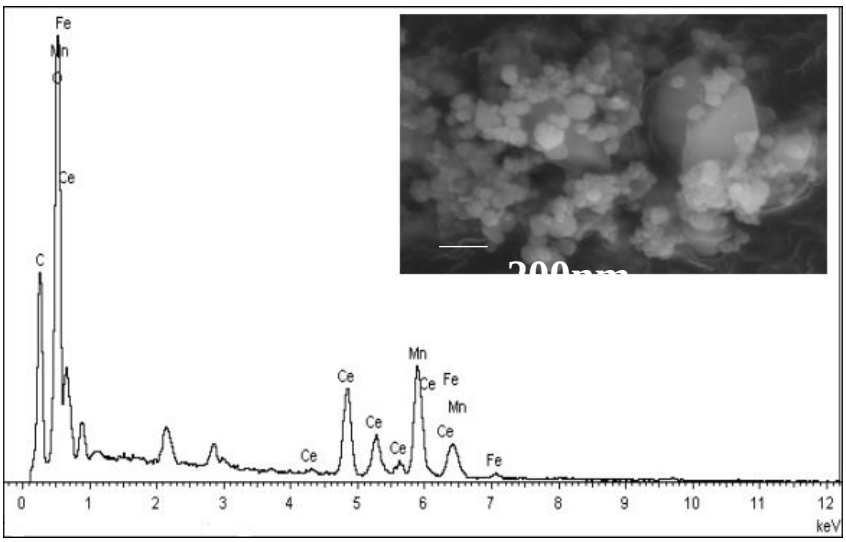


**Figure S2.** The element contents on the surface of graphene (EDS) and SEM images of Ce-Mn-Fe/GO-10%.

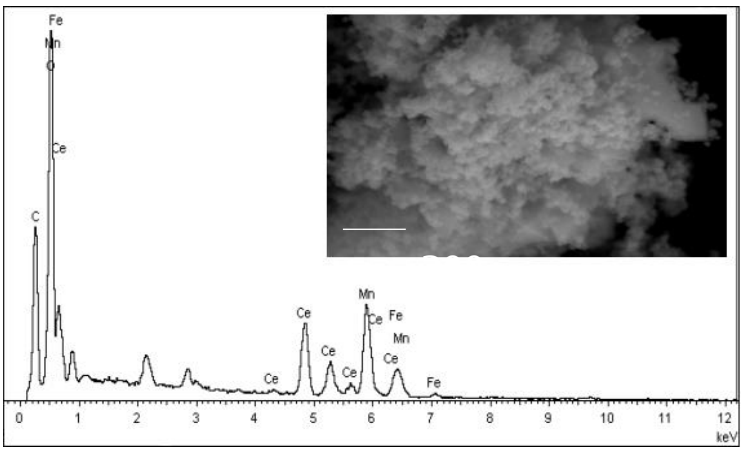


**Figure S3.** The element contents on the surface of graphene (EDS) and SEM images of Ce-Mn-Fe/GO-30%.

Figure S4 shows the activity of $NO_x$ reduction with $NH_3$ by Ce-Mn-Fe/GO-0, Ce-Mn-Fe/GO-10% and Ce-Mn-Fe/GO-30% composites at different temperatures. The $NO_x$ removal efficiencies over Ce-Mn-Fe/GO-x (x = 0, 10%, 30%) were studied at reaction temperatures with range from 100 to 400 °C. The efficiencies of $NO_x$ removal approximately 46%, 38% and 43% at 100 °C, respectively. For the sample of Ce-Mn-Fe/GO-0, the efficiency reaches to 84% at 150 °C, further, starting to decrease with the temperature increasing to 400 °C. The Ce-Mn-Fe/GO-10% and Ce-Mn-Fe/GO-30% obtained the highest efficiency with 81% and 80% at 200 °C and 250 °C, respectively. And then, the efficiencies decrease with increasing temperature, it is worth noting that the rate of decreases is much slower than the catalyst of Ce-Mn-Fe/GO-0, maybe the graphene has considerable effect on $NO_x$ removal.

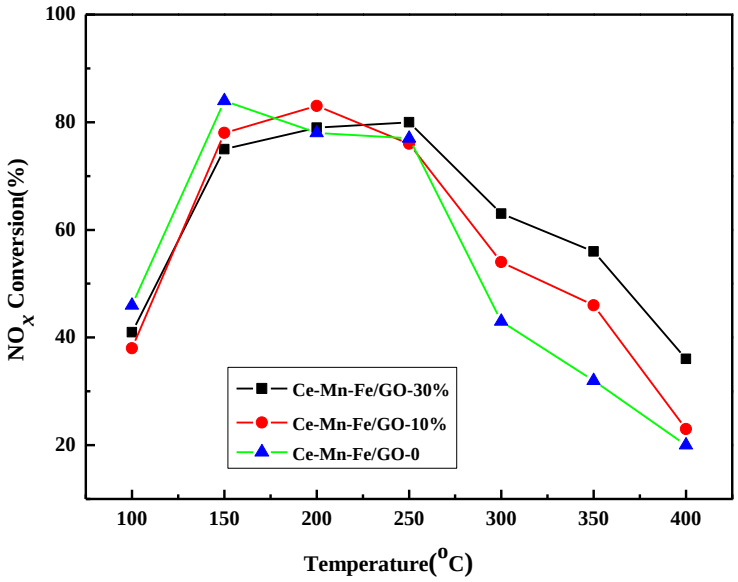


**Figure S4.** $NO_x$ conversion as a function of reaction temperature over the Ce-Mn-Fe/GO-x (x = 0, 10%, 30%) samples. (Reaction conditions: 800 ppm NO, 800 ppm $NH_3$, 6% $O_2$ and $N_2$ balance).

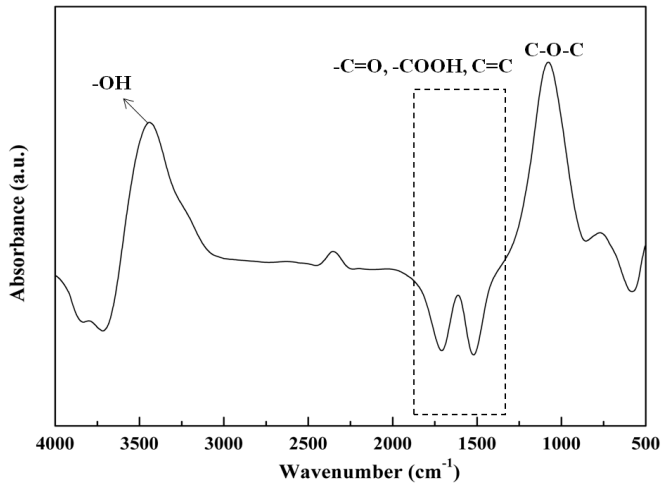


**Figure S5.** Fourier transform infrared spectra of GO.

As the Figure S5 shown, the peaks at 3600–3200 $cm^{-1}$ are assigned to the -OH stretching vibrations of alcohol, phenol and water [1]. The peaks at 1700–1585 $cm^{-1}$ are assigned to the C=O stretching vibrations of carbonyl and the C=C stretching vibrations of benzene; the peaks at 1440–1395 $cm^{-1}$ are assigned to the C=O stretching vibrations of carboxyl; and the peaks at 1200–1000 $cm^{-1}$ are assigned to the C-O-C stretching vibrations of alcohol, ether and anhydride [2].

## References

Jeong, H.-K.; Lee, Y.P.; Jin, M.H.; Kim, E.S.; Bae, J.J.; Lee, Y.H. Thermal stability of graphite oxide. *Chem. Phys. Lett.* **2009**, *470*, 255–258.

Ding, S.; Li, Y.; Zhu, T.; Guo, Y. Regeneration performance and carbon consumption of semi-coke and activated coke for $SO_2$ and NO removal. *J. Environ. Sci*. **2015**, *34*, 37–43.