

Mechanistic investigation on Hg^0 capture over MnO_x adsorbents: effects of the synthesis methods

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Performance of the adsorbents

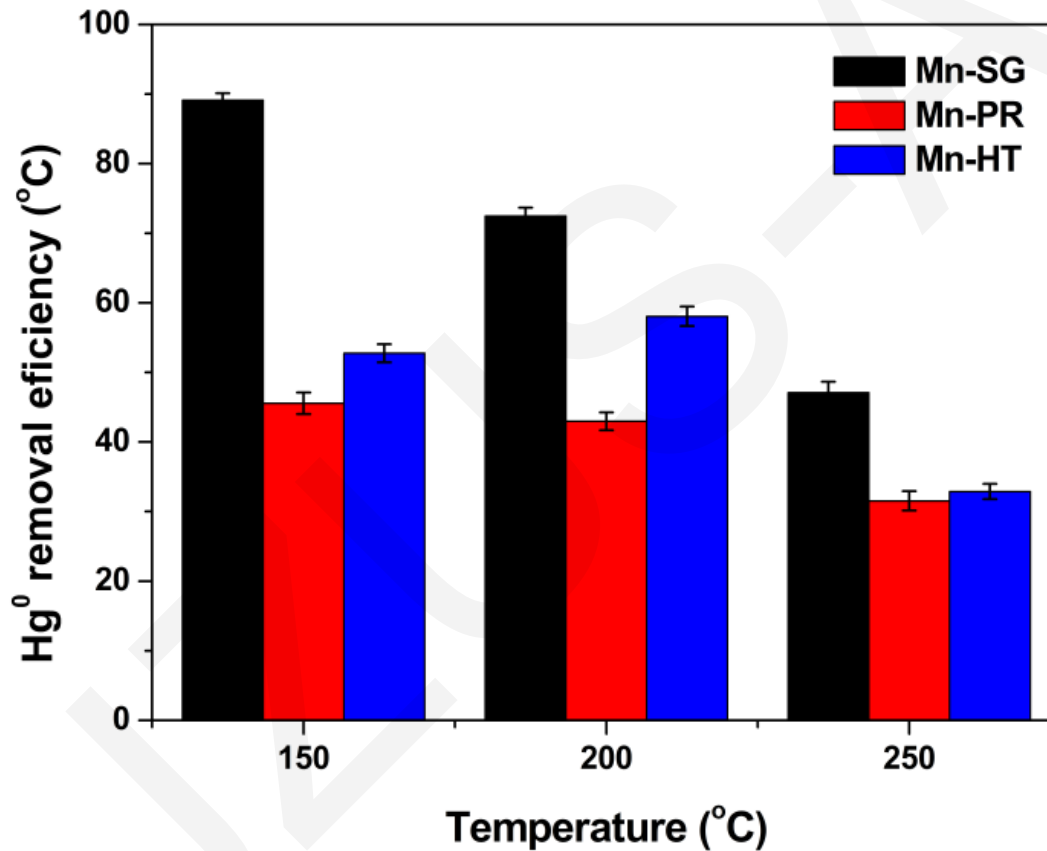


Fig. 1. Hg⁰ capture capability of the serial adsorbents.

Physicochemical properties

Table 1. N₂ adsorption results of the adsorbents.

Sample	Surface area (m ² /g)	Pore size (nm)	Pore volume (cm ³ /g)
Mn-SG	23	26.8	0.164
Mn-PR	7	25.5	0.046
Mn-HT	12	27.3	0.087

Physicochemical properties

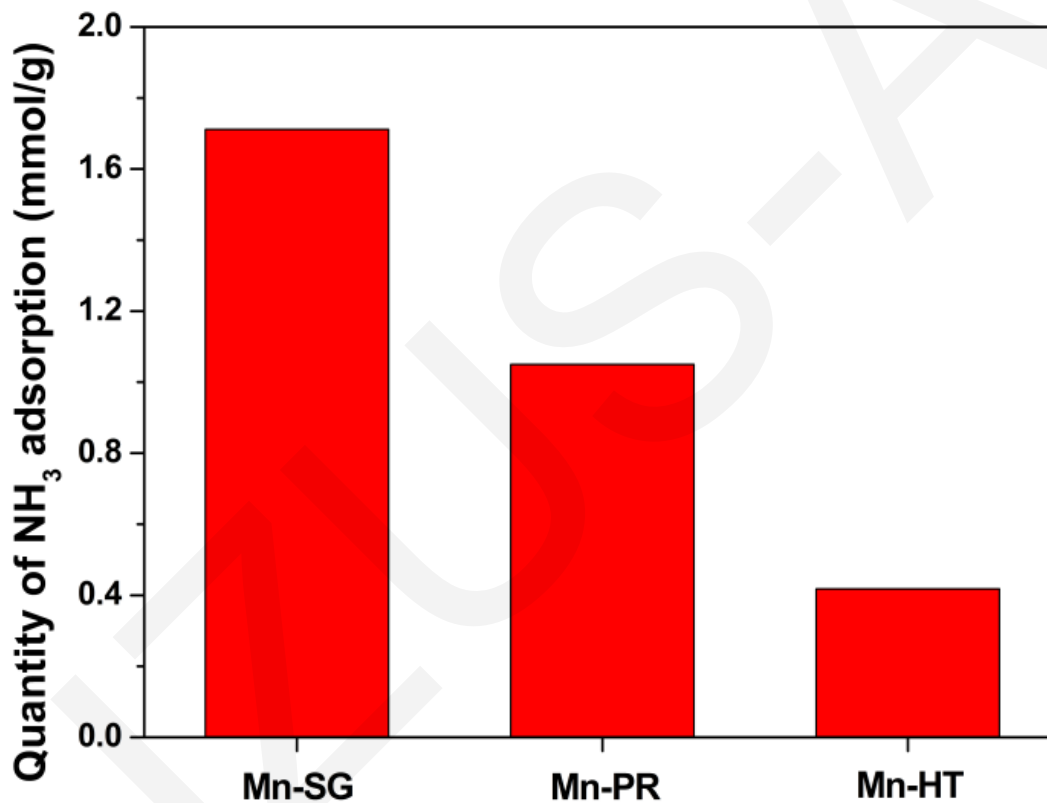


Fig. 4. NH₃-TPD results of the adsorbents.

Physicochemical properties

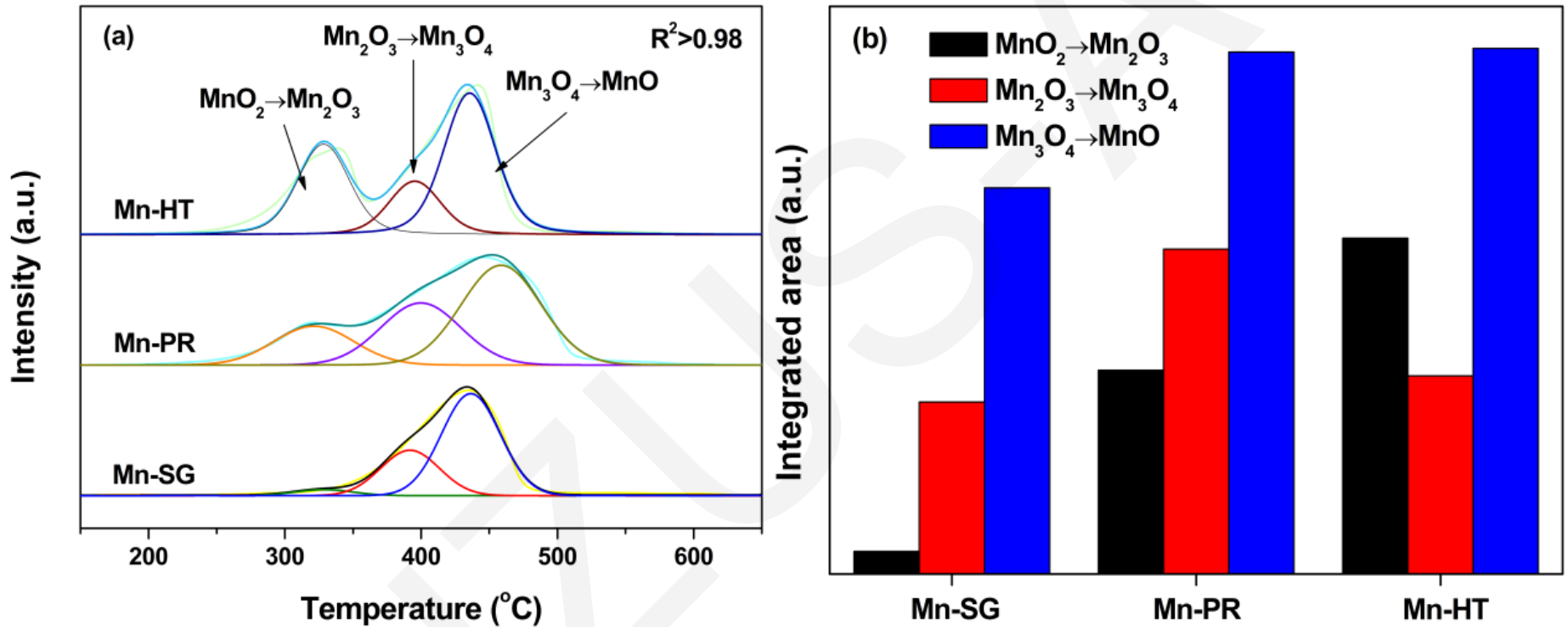
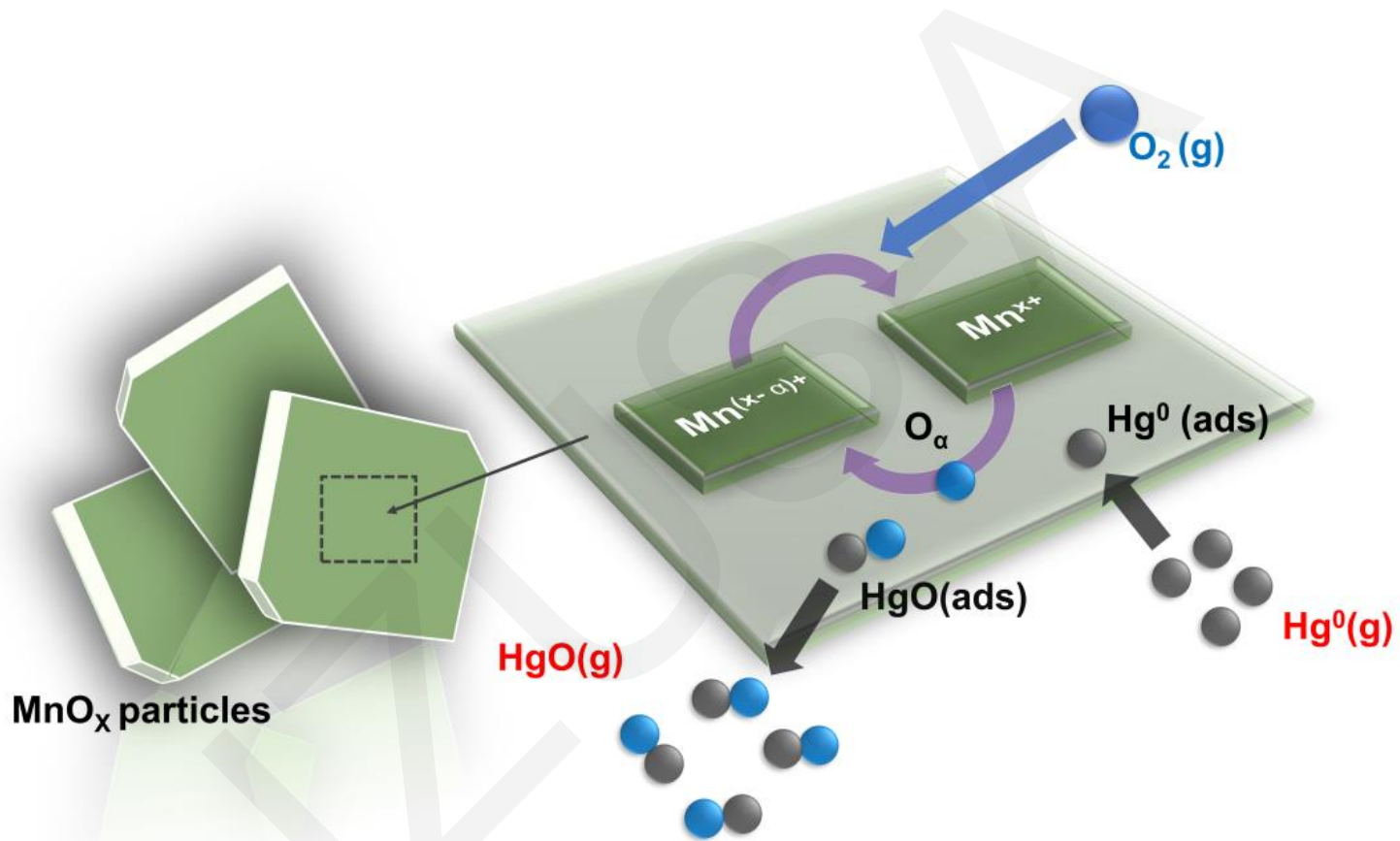


Fig. 5. (a) H₂-TPR profile and (b) semi-quantitative calculation results of the adsorbents.

Hg⁰ capture mechanism



Scheme 1 Hg⁰ removal mechanism over Mn-SG.

Three Representative Activities

■ Mechanics meets chemistry here and there

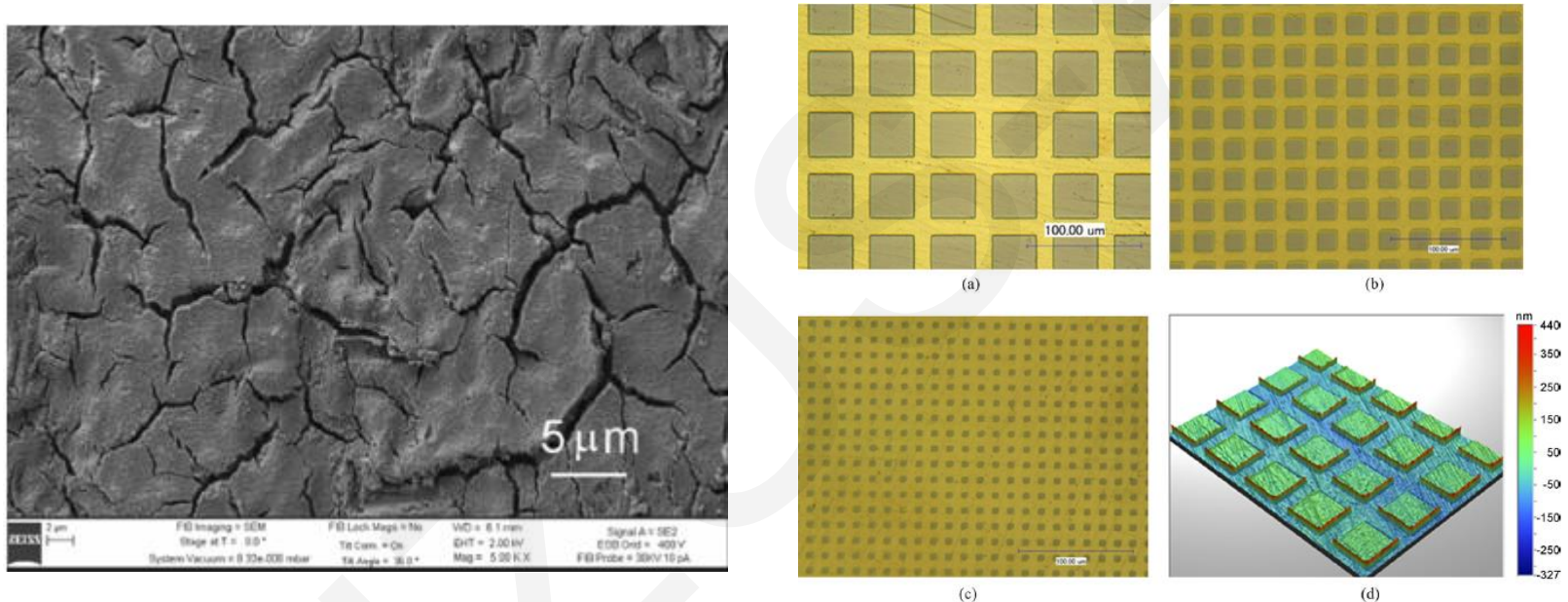


Fig. 3. Surface morphology of Si thin film and the patterns designed according to fracture mechanics analysis.

X. Xiao et al., Journal of Power Sources 196, 1409 (2011).

Conclusions

- Adsorbent prepared using the sol-gel method exhibits the best performance; *ca.* 90% Hg^0 removal performance is reached at 150 °C, almost doubling compared with that of Mn-PR.
- The presence of plentiful acid sites facilitates the physisorption of Hg^0 , providing ample Hg^0 for oxidation to HgO by the redox sites and subsequently enabling Mn-SG with a relatively high Hg^0 removal efficiency.
- Chemisorption dominates in all the Hg^0 abatement cycles, in which the initial adsorption stage constitutes the rate-determining step. The Mars-Maessen mechanism can explain the Hg^0 capture pathways over the adsorbents with Mn ions in a high valence state and O_α directly participating in the oxidation of Hg^0 .