Supplementary Materials: Synthesis of Hierarchical Titanium Silicalite-1 Using a Carbon-Silica-Titania Composite from Xerogel Mild Carbonization

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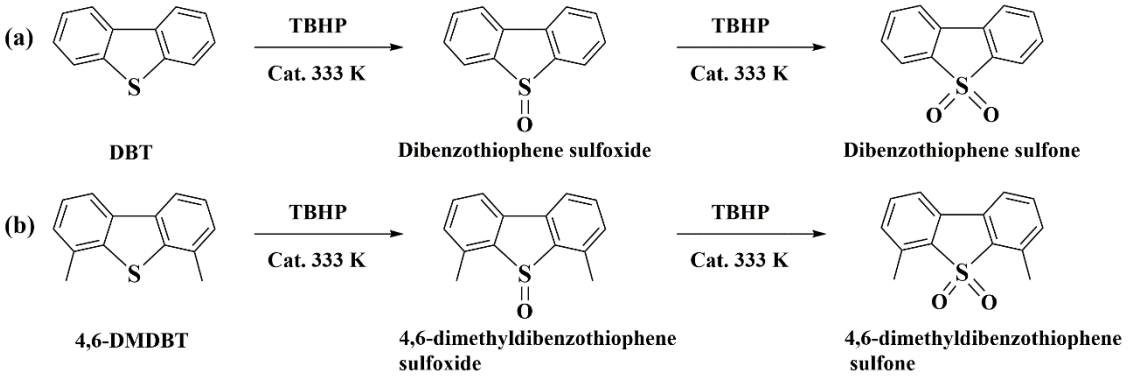
Table S1. Textural properties of carbon materials from different parent materials.

Sample [a]	S_{BET} ($m^2 g^{-1}$)	S_{micro} ($m^2 g^{-1}$)	S_{ext} ($m^2 g^{-1}$)	V_{micro} ($cm^3 g^{-1}$)	V_{meso} ($cm^3 g^{-1}$)
C from CSTd	535.8	202.8	333.0	0.10	0.13
C from as-synthesized HTS-1d	508.1	141.9	366.2	0.07	0.42
C from CSTp	279.4	80.6	198.8	0.04	0.24
C from CSTs	976.2	143.9	832.3	0.07	1.80
C from as-synthesized HTS-1s	905.7	75.1	830.6	0.03	1.84

[a] Carbon materials obtained by removals of silica and titania from corresponding parent materials using hydrofluoric acid aqueous solution.



Scheme S1. The reaction pathway for oxidative desulfurization of DBT and 4,6-DMDBT over HTS-1s.

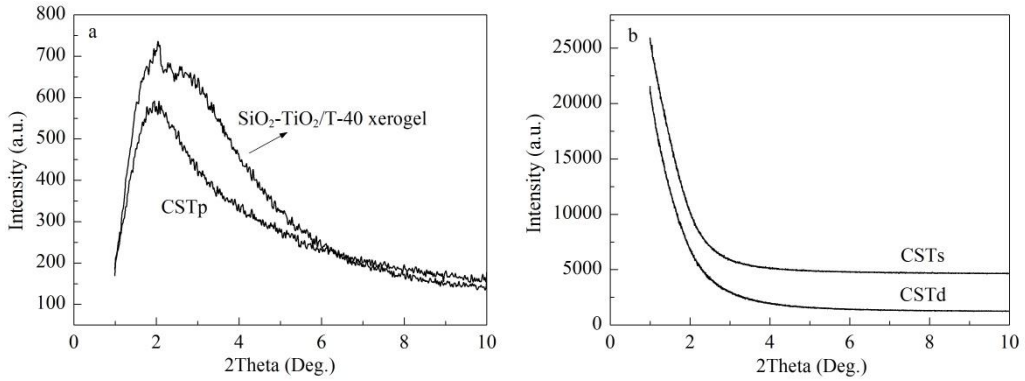


Figure S1. XRD patterns of samples: (**a**) ST/T-40 xerogel and CST composite prepared by pre-treating the ST/T-40 xerogel with dilute sulfuric acid (CSTp); (**b**) CST composites prepared by carbonization of ST/T-40 xerogels with (CSTs) or without (CSTd) the aid of sulfuric acid.

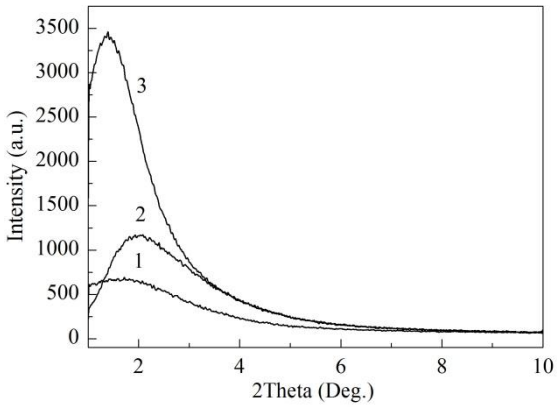


Figure S2. XRD patterns of SiO_2-TiO_2 composites obtained by combustion of ST/T-40 xerogel (1), CSTd (2), and CSTs (3) in air at 823 K for 5 h.

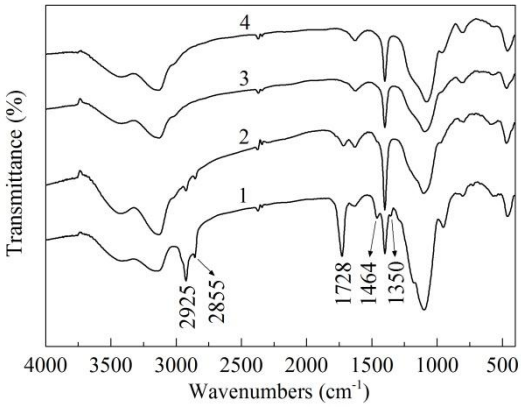


Figure S3. FT-IR spectra of ST/T-40 xerogel and CST composites: (1) ST/T-40 xerogel; (2) CSTp; (3) CSTs; (4) CSTd.

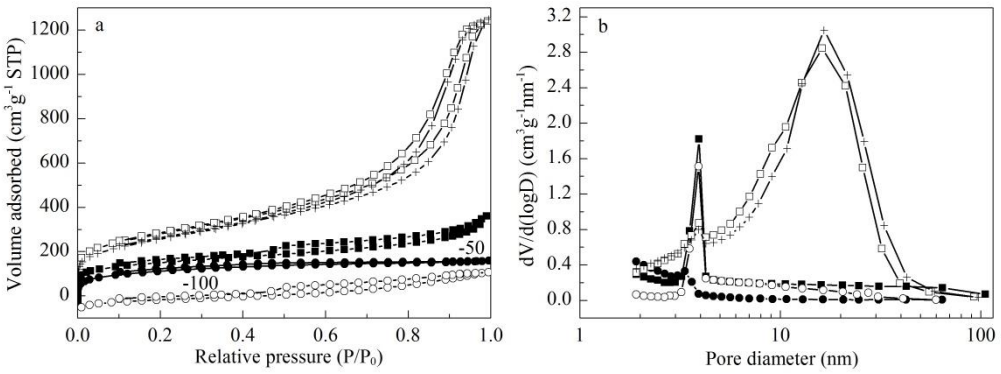


Figure S4. Nitrogen adsorption-desorption isotherms (**a**) and pore size distributions (**b**) of carbon materials obtained by removals of silica and titania from different parent materials with hydrofluoric acid aqueous solution: (●) carbon material from CSTd; (■) carbon material from as-synthesized HTS-1d; (o) carbon material from CSTp; (□) carbon material from CSTs; (+) carbon material from as-synthesized HTS-1s.

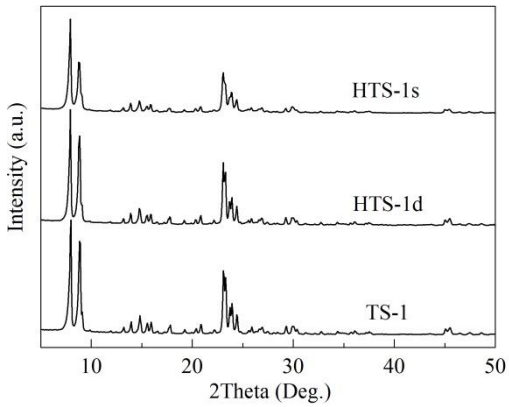


Figure S5. XRD patterns of TS-1, HTS-1d, and HTS-1s.

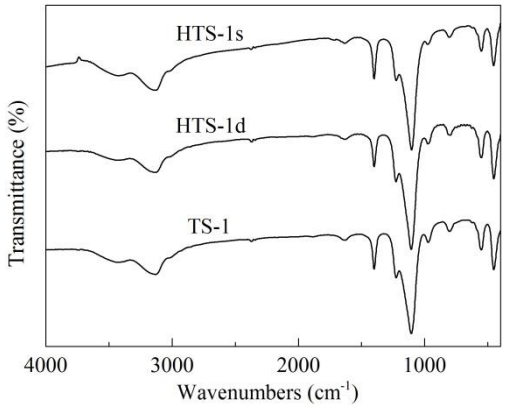


Figure S6. FT-IR spectra of TS-1, HTS-1d, and HTS-1s.

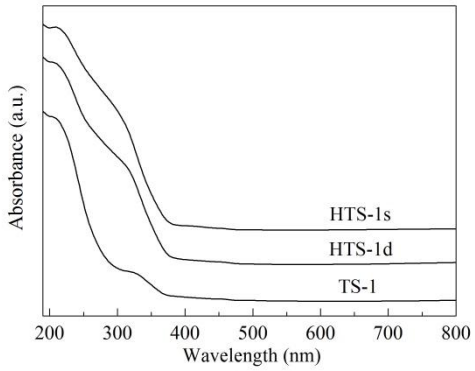


Figure S7. UV–Vis spectra of TS-1, HTS-1d, and HTS-1s.

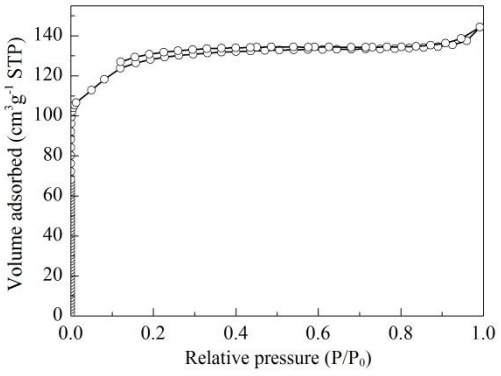


Figure S8. Nitrogen adsorption-desorption isotherms of TS-1.

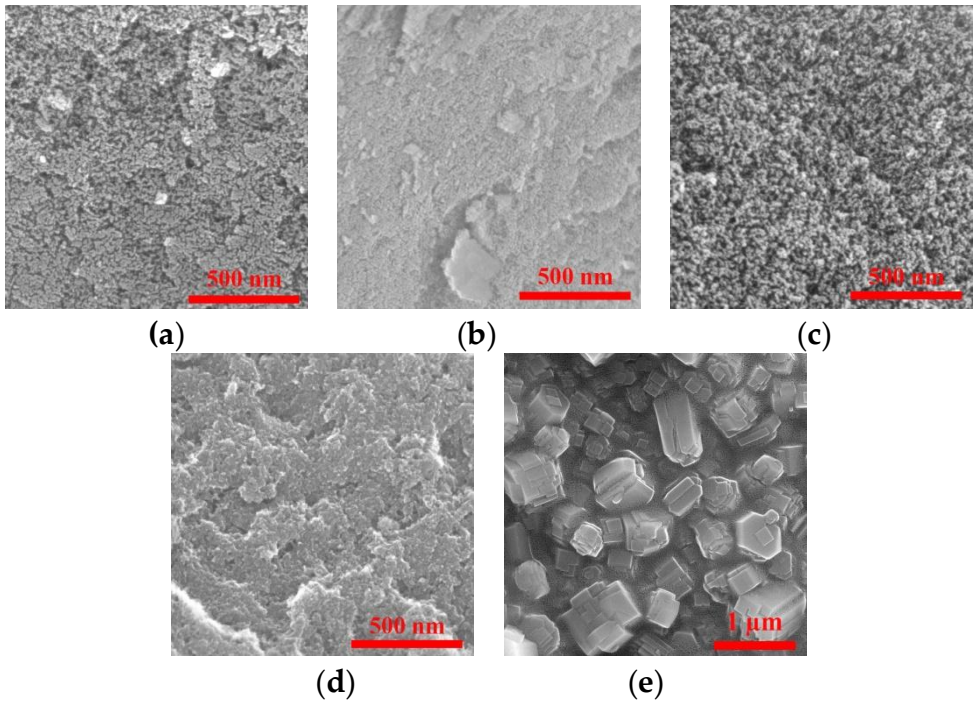


Figure S9. SEM images of CSTs (**a**), CSTd (**b**), carbon materials obtained by removals of silica and titania from as-synthesized HTS-1s (**c**) and HTS–1d (**d**) with hydrofluoric acid aqueous solution, and TS-1 (**e**).

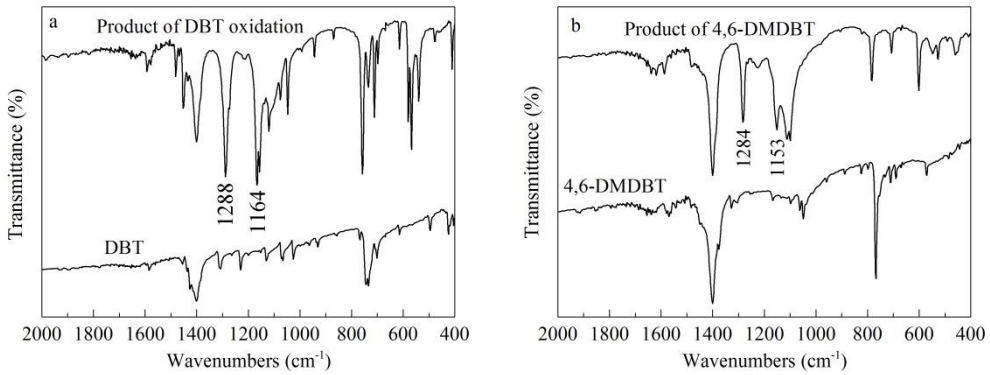


Figure S10. FT-IR spectra of reactants and their corresponding products: (**a**) DBT and its oxidation product; (**b**) 4,6-DMDBT and its oxidation product.

Figure S11. Image of a typical reaction medium after the reaction was finished for 3 min.

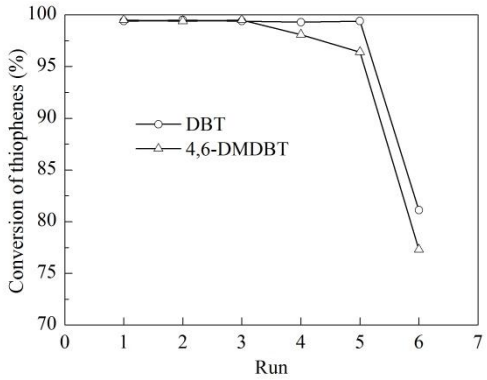


Figure S12. Recycle tests in the oxidation of DBT and 4,6–DMDBT over HTS–1s recovered by centrifugation and drying at 373 K.

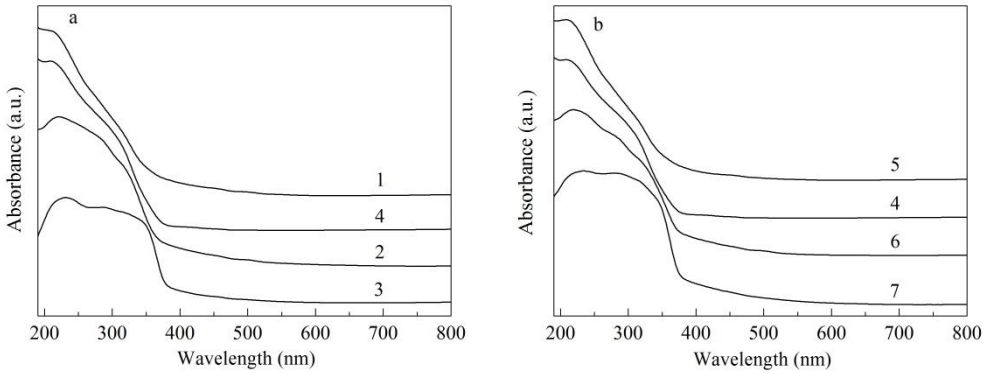


Figure S13. UV–Vis spectra of the fresh, used, and regenerated HTS-1s for DBT (**a**) and 4,6-DMDBT (**b**) oxidations: (1) HTS-1s regenerated by calcination after the 15th run; (2) HTS-1s recovered by centrifugation and drying after the sixth run; (3) product of DBT oxidation; (4) fresh HTS-1s; (5) HTS–1s regenerated by calcination after the 15th run; (6) HTS–1s recovered by centrifugation and drying after the sixth run; (7) product of 4,6–DMDBT oxidation.

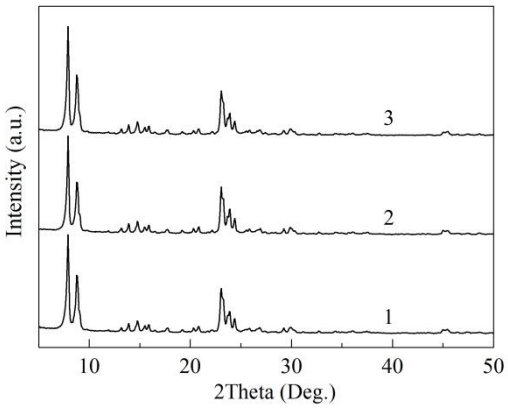


Figure S14. XRD patterns of fresh HTS-1s (1) and regenerated HTS-1s catalysts for DBT (2) and 4,6-DMDBT (3) oxidations.

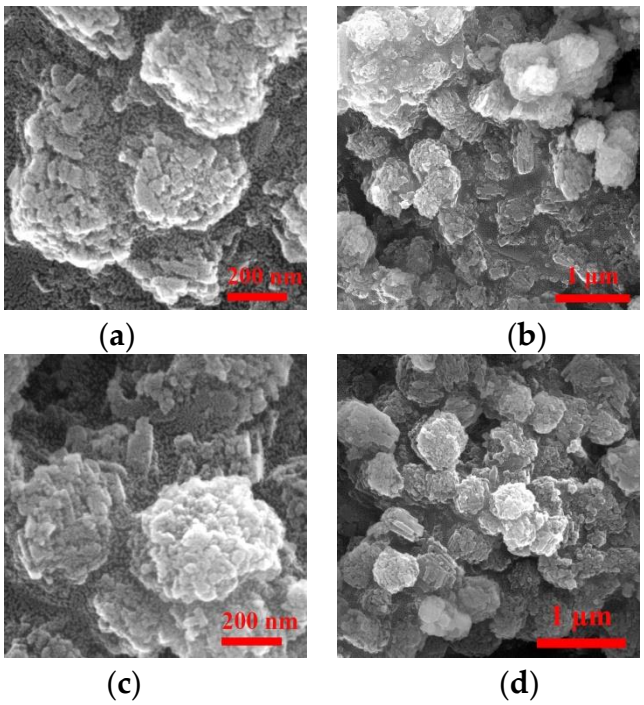


Figure S15. SEM images of the regenerated HTS-1s after the 15th run: (**a**) and (**b**) for 4,6-DMDBT oxidation; (**c**) and (**d**) for DBT oxidation.