

## Electronic Supplementary Information

### Superior catalytic performance of $\text{CoO}_x/\text{Sn-CeO}_2$ hybrid material for catalytic diesel soot oxidation

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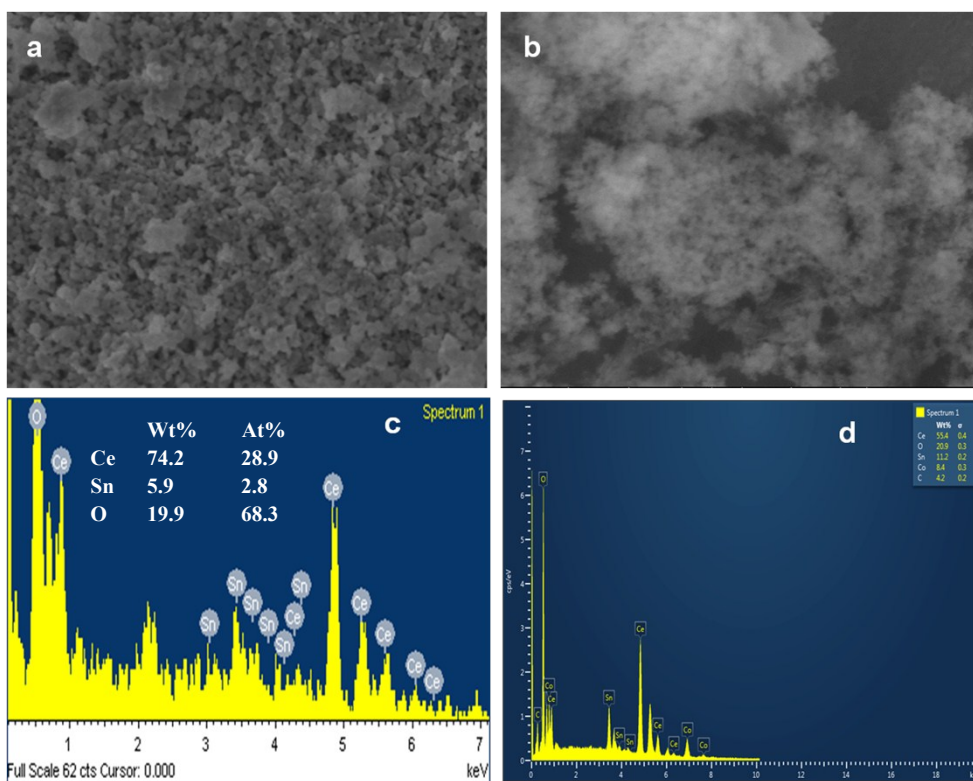
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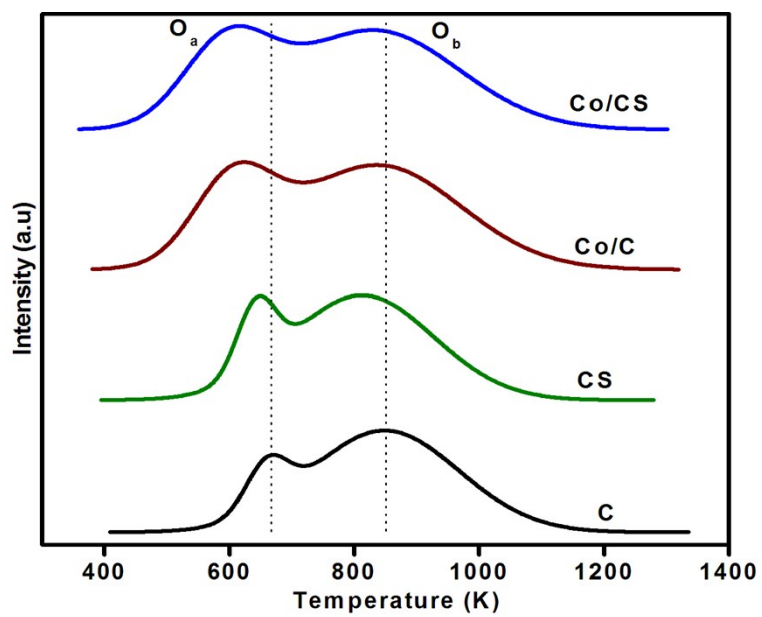
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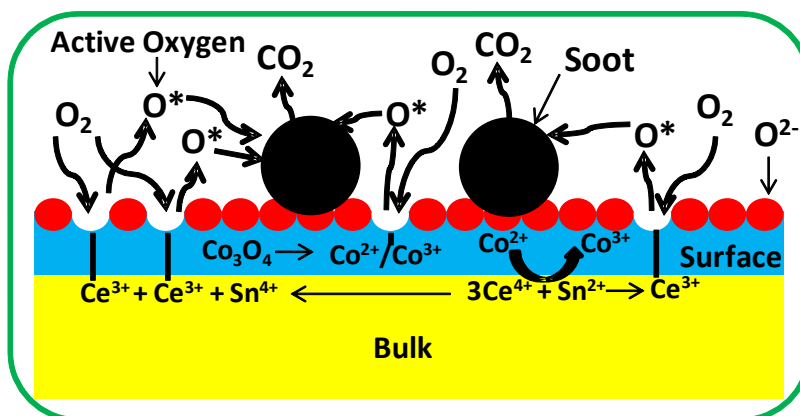
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**Figure S1:** FESEM (a, b) and EDX (c, d) images of tin-doped-ceria (CS) and tin-doped-ceria supported  $\text{CoO}_x$  (Co/CS) calcined at 773 K.



**Figure S2:** O<sub>2</sub>-TPD profiles of pure ceria (C), tin-doped-ceria (CS), ceria supported CoO<sub>x</sub> (Co/C), and tin-doped-ceria supported CoO<sub>x</sub> (Co/CS) calcined at 773 K.



**Figure S3:** Proposed reaction mechanism of soot oxidation over the tin-doped-ceria supported  $\text{CoO}_x$  (Co/CS) calcined at 773 K.

The proposed soot oxidation mechanism over the Co/CS catalysts is described in Figure S3. Initially, the oxygen vacancies are created by the synergistic interaction among the  $\text{Co}^{2+}/\text{Co}^{3+}$ ,  $\text{Sn}^{2+}/\text{Sn}^{4+}$ , and  $\text{Ce}^{3+}/\text{Ce}^{4+}$  redox couples at the  $\text{Co}_3\text{O}_4/\text{CeO}_2\text{-SnO}_2$  interface. The  $\text{Co}_3\text{O}_4$  to  $\text{Co}^{2+}/\text{Co}^{3+}$  transformation also generates some oxygen vacancies on the surface of the sample. The active oxygen species (usually  $\text{O}_2^-$  species) could be formed by the adsorption of gaseous  $\text{O}_2$  on the oxygen vacancies. Subsequently, these active oxygen species spills over the catalyst to the adjacent soot particles and oxidizes the soot. Therefore, the formation of more surface oxygen vacancies could make the adsorption of gas-phase oxygen easily and create more active oxygen which could improve the soot oxidation performance.