

## The enhancement of the catalytic performance of $\text{CrO}_x/\text{Al}_2\text{O}_3$ catalysts for ethylbenzene dehydrogenation through tailored coke deposition

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### Supplementary Information

Table S1. Position of the Raman bands, D1/G and D1/D3 ratios of pre-coked  $\text{CrO}_x/\text{Al}_2\text{O}_3$  with benzene, toluene, styrene and ethylene at 600 °C for 6 h time-on-stream.

Fig. S1. Cr 2p XP spectrum of a) fresh  $\text{CrO}_x/\text{Al}_2\text{O}_3$  and b)  $\text{CrO}_x/\text{Al}_2\text{O}_3$  pre-coked with benzene. Reference fitting values were utilized for Cr(III). The fresh catalyst shows the satellite peak ( $2p_{3/2}$  sat.) at 591 eV.

**Table S1.** Position of the Raman bands, D1/G and D1/D3 ratios of pre-coked CrO<sub>x</sub>/Al<sub>2</sub>O<sub>3</sub> with benzene, toluene, styrene and ethylene at 600 °C for 6 h time-on-stream.

|                         |                              | <b>CrO<sub>x</sub>/Al<sub>2</sub>O<sub>3</sub> pre-coked with:</b> |                |                |                 |
|-------------------------|------------------------------|--|----------------|----------------|-----------------|
|                         |                              | <b>benzene</b>   | <b>toluene</b> | <b>styrene</b> | <b>ethylene</b> |
| <b>D4</b>               | position (cm <sup>-1</sup> ) | 1208   | 1211           | 1214           | 1202            |
|                         | FWHM (cm <sup>-1</sup> )     | 51   | 112            | 122            | 93              |
| <b>D1</b>               | position (cm <sup>-1</sup> ) | 1303   | 1319           | 1322           | 1335            |
|                         | FWHM (cm <sup>-1</sup> )     | 126  | 163            | 166            | 151             |
| <b>D3</b>               | position (cm <sup>-1</sup> ) | 1491   | 1500           | 1500           | 1501            |
|                         | FWHM (cm <sup>-1</sup> )     | 229  | 244            | 238            | 292             |
| <b>G</b>                | position (cm <sup>-1</sup> ) | 1599   | 1593           | 1596           | 1592            |
|                         | FWHM (cm <sup>-1</sup> )     | 57   | 68             | 69             | 51              |
| <b>Intensity ratios</b> |                              |  |                |                |                 |
| <b>D1/G</b>             |                              | 2.7 ± 0.1  | 2.8 ± 0.1      | 3.1 ± 0.2      | 4.5 ± 0.2       |
| <b>D1/D3</b>            |                              | 4.0 ± 0.2  | 2.3 ± 0.1      | 2.2 ± 0.1      | 1.9 ± 0.1       |

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