**Supplementary Information**



**Fig. S1**. Schematic for the VOCs degradation instrument.



**Fig. S2.** Arrhenius plot for rate constant of C7H8 conversion with LaAMnNiO6 (A = La, Pr, Sm).

**TABLE SI.** XPS results of LaAMnNiO6 (A = La, Pr, Sm).

|  |  |  |
| --- | --- | --- |
| Catalysts | Surface atomic concentration (%) | Relative atomic ratio (%) |
| LaAMnNiO6 | La | Pr | Sm | Mn | Ni | O | Oabs./Olatt | Mn4+/ Mn3+ |
| La2MnNiO6 | 14.55 | - | - | 10.37 | 25.03 | 50.05 | 0.93 | 0.67 |
| LaPrMnNiO6 | 5.54 | 5.53 | - | 9.95 | 16.17 | 62.82 | 0.95 | 0.81 |
| LaSmMnNiO6 | 6.45 | - | 6.49 | 9.12 | 17.58 | 60.41 | 0.99 | 0.83 |

**TABLE SII.** Data obtained from O2-TPD.

|  |  |
| --- | --- |
| Catalysts | O2 consumption before 700 °C (cm3/g) |
| LaAMnNiO6 | Total | Oα | Oβ |
| La2MnNiO6 | 3.02 | 0.93 | 2.09 |
| LaPrMnNiO6 | 3.19 | 1.09 | 2.10 |
| LaSmMnNiO6 | 3.84 | 1.14 | 2.70 |

**TABLE S III.** Data obtained from H2-TPR.

|  |  |
| --- | --- |
| Catalysts | H2 consumption before 700 °C (cm3/g) |
| LaAMnNiO6 | Total | α | β | γ |
| La2MnNiO6 | 62.18 | 5.25 | 6.18 | 19.03 |
| LaPrMnNiO6 | 59.93 | 5.46 | 8.95 | 17.21 |
| LaSmMnNiO6 | 53.42 | 5.55 | 14.60 | 15.59 |

**TABLE S IV.** Comparison with single-phase perovskite with literature.

|  |  |  |  |
| --- | --- | --- | --- |
| Catalysts | activity temperature (°C) | Ea (kJ/mol) | Reference |
| LaMnO3 | 265 | 78 | [20] |
| LaCoO3 | 270 | 143 | [20] |
| LaNiO3 | 280 | 79 | [20] |
| La2MnNiO6 | 260 | 129 | This study |
| LaPrMnNiO6 | 257 | 75 | This study |
| LaSmMnNiO6 | 255 | 49 | This study |