Supporting Information

# *In situ* synthesis of highly-active Pt nanoclusters via thermal decomposition for high-temperature catalytic reactions

Shao-Cong Ouyang[1, †], Li-Wei Wang[2, †], Xi-Wen Du[1], Cui Zhang[2,*], Jing Yang[1,*]

[1]Institute of New-Energy Materials, Tianjin Key Laboratory of Composite and Functional Materials, School of Materials Science and Engineering, Tianjin University, Tianjin 300072, P. R. China.

[2]Institute of New Catalytic Materials Science, College of Chemistry, Nankai University, Tianjin 300071, P. R. China.

*Corresponding authors.

*E-mail address*: yang_jing@tju.edu.cn (J. Yang); zhangcui@nankai.edu.cn (C. Zhang).

[†]These authors contribute equally to this work.

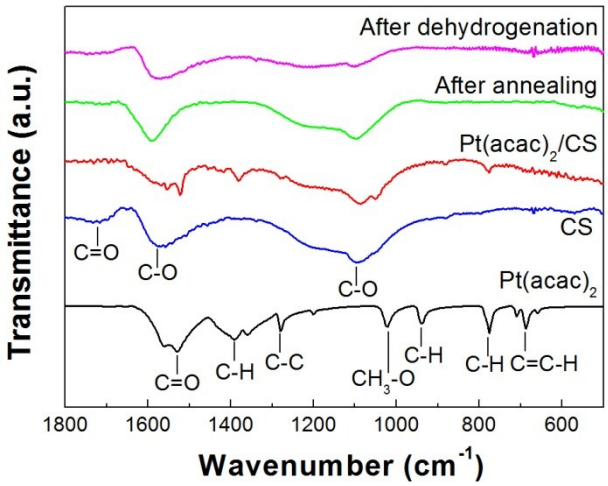


**Figure S1**. FTIR spectra of $Pt(acac)_2$, CS, $Pt(acac)_2$/CS composites with a Pt content of 2.83 wt%, the composites after being annealed at 320 °C for 30 min in nitrogen atmosphere, and the composites following the catalytic dehydrogenation reaction.

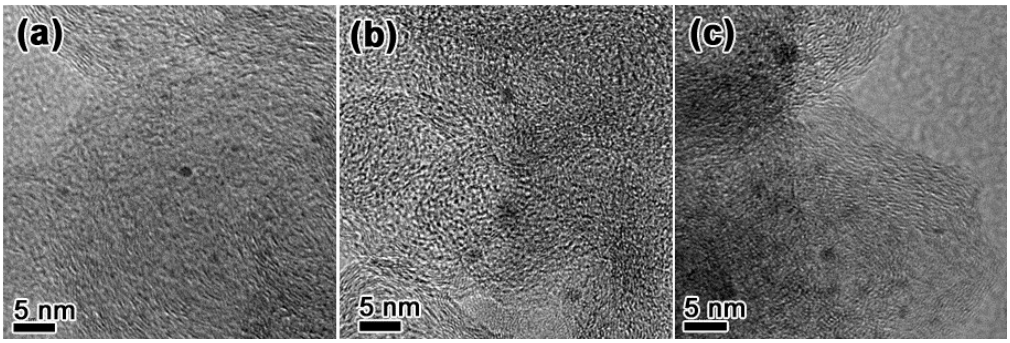


**Figure S2**. TEM images of as-prepared samples with different Pt contents. (a) 0.18wt%, (b) 0.37wt%, and (c) 0.60wt%.

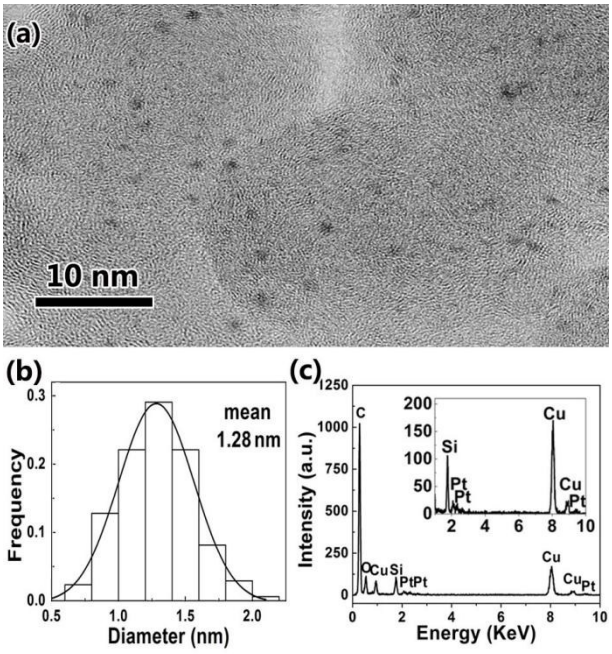


**Figure S3**. (a) TEM image of the Pt nanoclusters on CS with a Pt loading of 2.83wt%. (b) The size histogram with Gaussian fitting for the NPs. (c) EDX spectrum of the Pt/C composites. The inset is an enlarged view.

**Table S1.** Hydrogen evolution rate of MCH over various Pt-based catalysts.

| Catalysts | Preparation technique | Temp ($^oC$) | $H_2$ evolution rate ($mmol/g_{met}/min$) | Ref. |
|---|---|---|---|---|
| .4wt% Pt/CB | Wet impregnation | 300 | 342 | [21] |
| 10%wt% Pt/ACC | Wet impregnation | 298 | 520 | [24] |
| 3wt% Pt/$La_2O_3$ | Wet impregnation | 350 | 21.1 | [25] |
| 1wt% Pt/$La_{0.7}Y_{0.3}NiO_3$ | Wet impregnation | 350 | 45.76 | [25] |
| 3wt% Pt/$V_2O_5$ | Wet impregnation | 350 | 330 | [26] |
| 3wt% Pt/$Y_2O_3$ | Wet impregnation | 350 | 772 | [26] |
| 0.37wt% Pt/CS | *In-situ* method | 320 | 575 | This work |

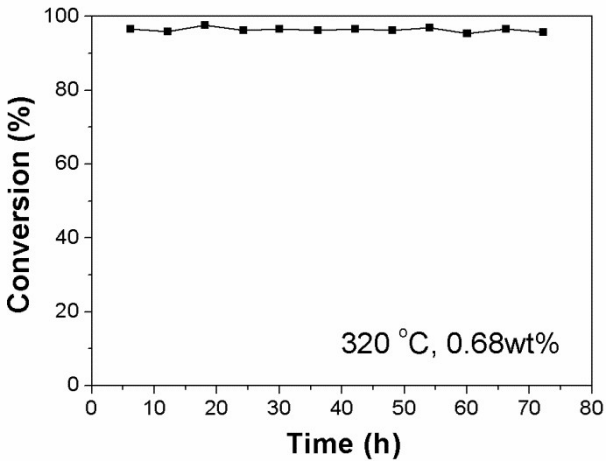


**Figure S4**. The durability of the catalyst with a Pt loading of 0.68wt% at 320 °C.