



1 Supporting Information

2 Pt Nanocluster Co-Catalysts for Photocatalytic Water 3 Splitting

4 Cameron J. Shearer^{1,*}, Jason F. Alvino¹, Munkhbayar Batmunkh², Gregory F. Metha^{1,*}

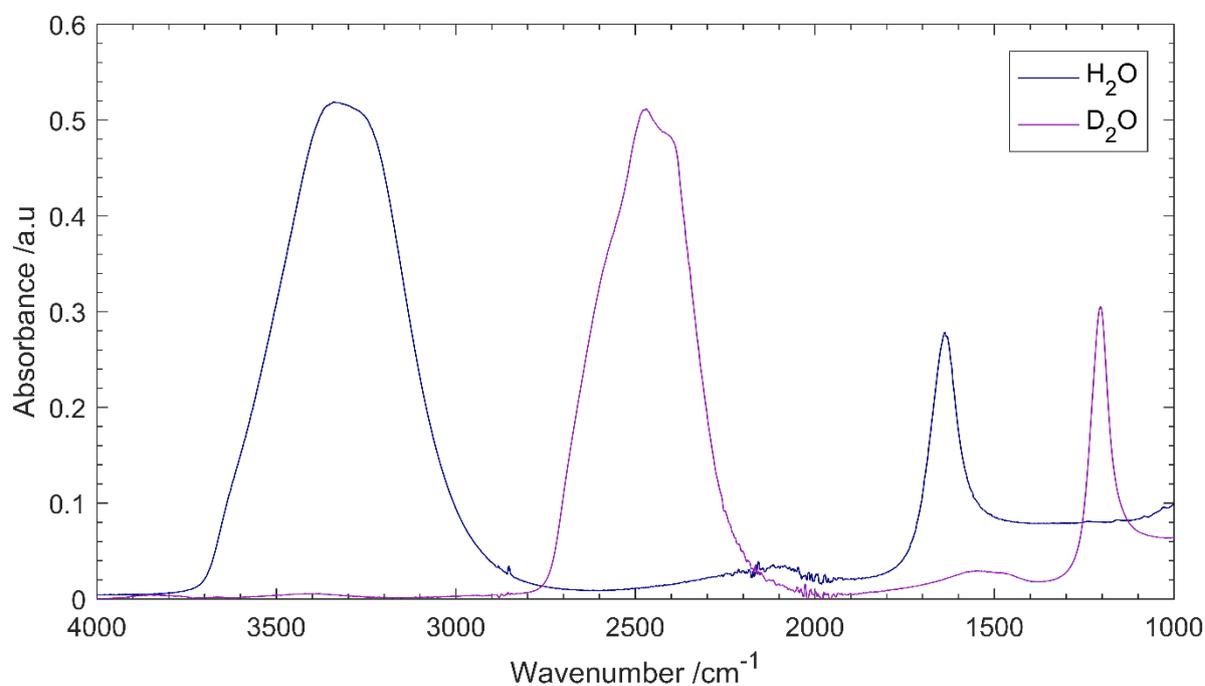
5 ¹ Department of Chemistry, The University of Adelaide, Adelaide, SA 5005, Australia;
6 jason.alvino@adelaide.edu.au

7 ² Australian Institute for Bioengineering and Nanotechnology, The University of Queensland, St Lucia,
8 Brisbane, QLD 4072, Australia; m.batmunkh@uq.edu.au

9 * Correspondence: cameron.shearer@adelaide.edu.au (C.J.S.); greg.metha@adelaide.edu.au (G.F.M.);
10 Tel.: +61-8-8313-4332 (C.J.S)

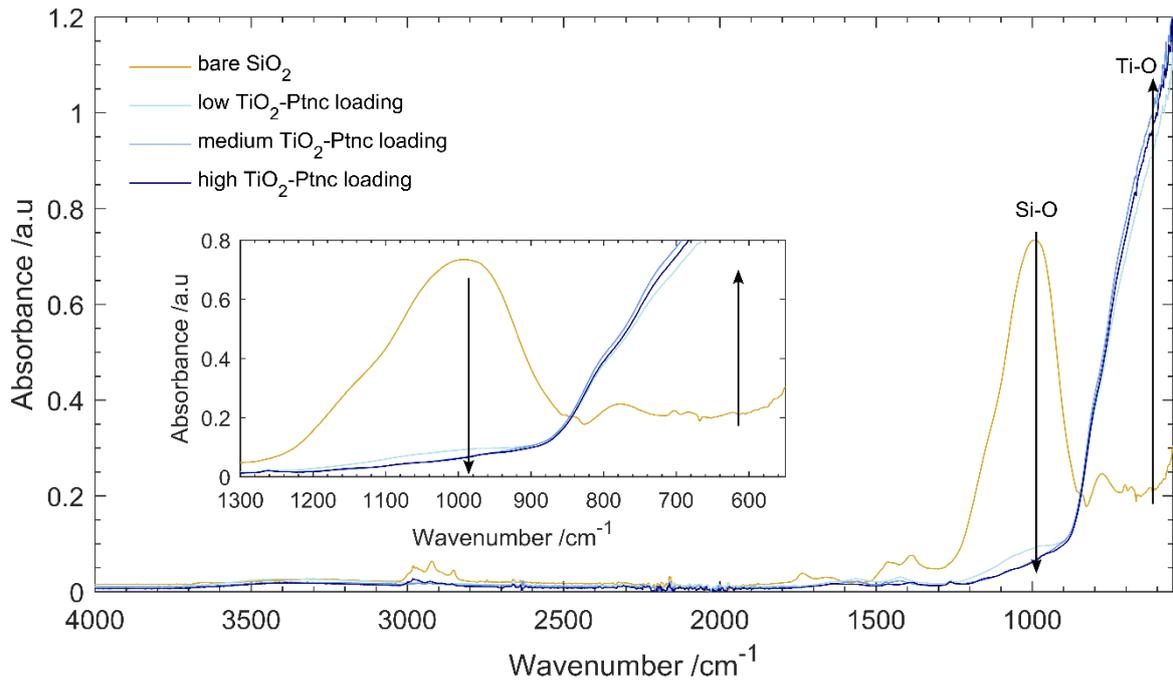
11 Received: 18 October 2018; Accepted: 19 November 2018; Published: 22 November 2018

12 Supporting Information



13

14 **Figure S1.** Attenuated total reflection Fourier transform infrared (ATR-FTIR) spectra showing
15 absorbance of H₂O (navy series) and D₂O (purple series) placed onto the ATR crystal which shows
16 that the D₂O is pure.



17

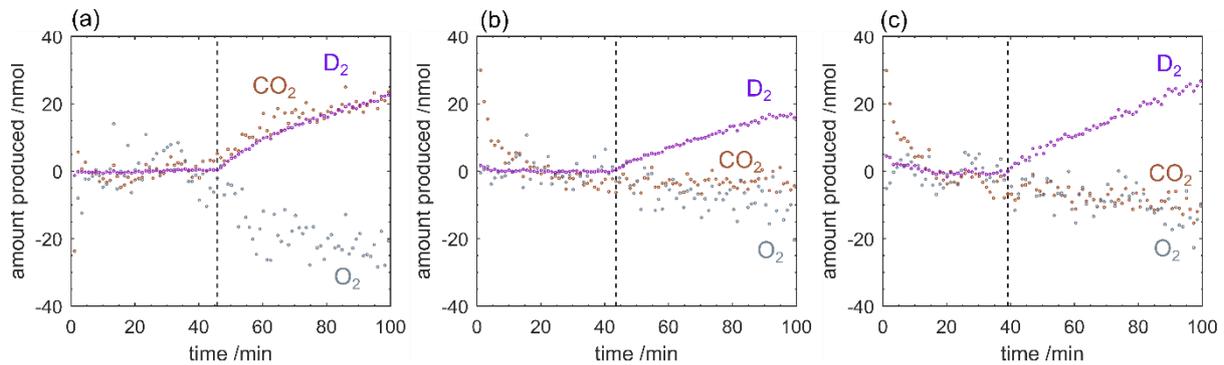
18

19

20

21

Figure S2. ATR-FTIR spectra of glass microfiber discs loading with increasing mass/area P25-Ptnc photocatalyst showing bare (0 mg/cm), low (~1.5 mg/cm), medium (~3 mg/cm) and high (~5 mg/cm) loading. From the disappearance of the Si-O stretch at 1000 cm^{-1} , the surface is coated for the medium and high loadings and the low loading has a very small fraction of uncoated surface.



22

23

24

25

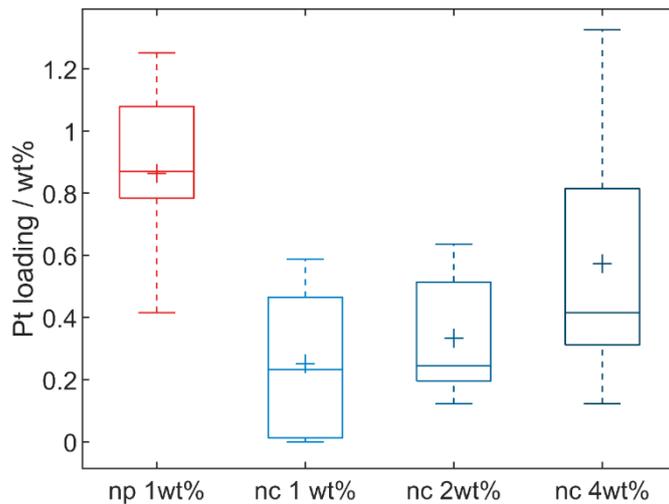
26

27

28

Figure S3. Repeated photocatalysis experiments for a Pt-nc sample (1 wt%) showing the production of D_2 (purple, $m/z = 4$), O_2 (grey, $m/z = 32$) and CO_2 (brown, $m/z = 44$) for repeated experiments. In the first experiment, CO_2 is produced and O_2 is consumed. In subsequent experiments CO_2 and O_2 are not produced or consumed. Investigation is continuing to determine why O_2 is not produced. Previous experiments have shown a delay of 10 h for O_2 production in gas phase D_2O splitting which was attributed to O_2 capture by the semiconductor.¹

29

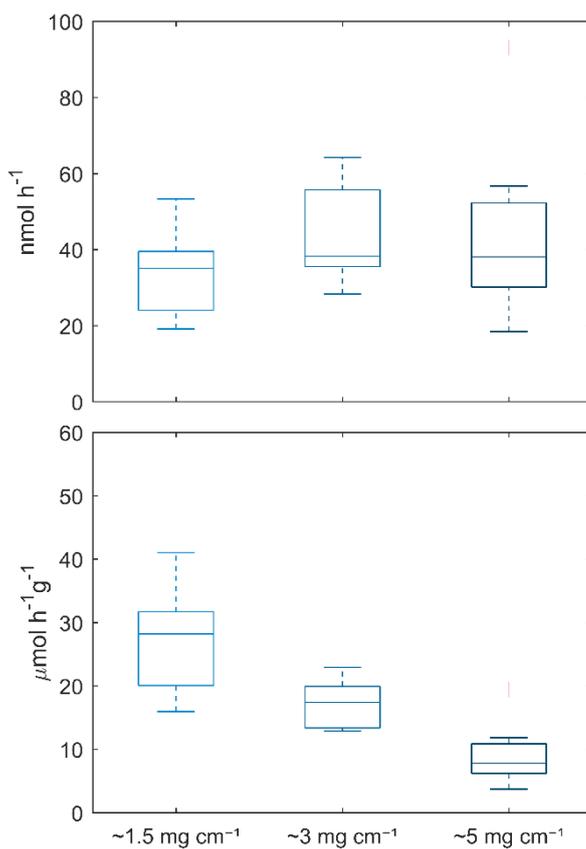


30

31

32

Figure S4. Pt mass loading % for each sample determined by EDS. >10 individual areas were investigated by EDS for each sample.

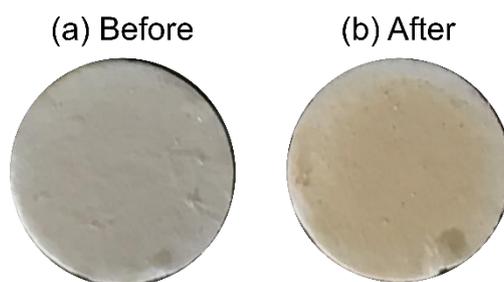


33

34

35

Figure S5. Comparison of D₂ production rates with photocatalyst (P25-Ptnc-2wt%) loading. The data are presented with (upper figure) and without (lower figure) dividing by photocatalyst mass.



36

37

38

Figure S6. Digital photographs of P25-Pt-nc-1wt% photocatalytic disc (a) before and (b) after 3 repeated UV photocatalytic D₂ production experiments.

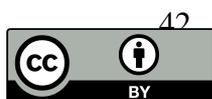
39

References

40

41

1. Kawai, T; Tadayoshi Sakata, T. Photocatalytic decomposition of gaseous water over TiO₂ and TiO₂-RuO₂ surfaces. *Chem. Phys. Lett.* **1980**, 72,87-89. 10.1016/0009-2614(80)80247-8



© 2018 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).