

[Electronic Supplementary Information]

Synthesis of chestnut-bur-like palladium nanostructures and their enhanced electrocatalytic activities for ethanol oxidation

Seong Ji Ye,^{‡a} Do Youb Kim,^{‡b} Shin Wook Kang,^{c,d} Kyeong Woo Choi,^a
Sang Woo Han,^{c,d} O Ok Park^{*a}

^a*Department of Chemical and Biomolecular Engineering (BK21+ graduate program), Korea Advanced Institute of Science and Technology (KAIST), 291 Daehak-ro, Yuseong-gu, Daejeon 305-701, Republic of Korea.*

^b*Advanced Materials Division, Korea Research Institute of Chemical Technology (KRICT), 141 Gajeong-ro, Yuseong-gu, Daejeon 305-600, Republic of Korea.*

^c*Department of Chemistry and KI for the Nanocentry, Korea Advanced Institute of Science and Technology (KAIST), 291 Daehak-ro, Yuseong-gu, Daejeon 305-701, Republic of Korea.*

^d*Center for Nanomaterials and Chemical Reactions, Institute for Basic Science (IBS), Daejeon 305-701, Republic of Korea.*

E-mail: oopark@kaist.ac.kr

[‡]These authors contributed equally to this work.

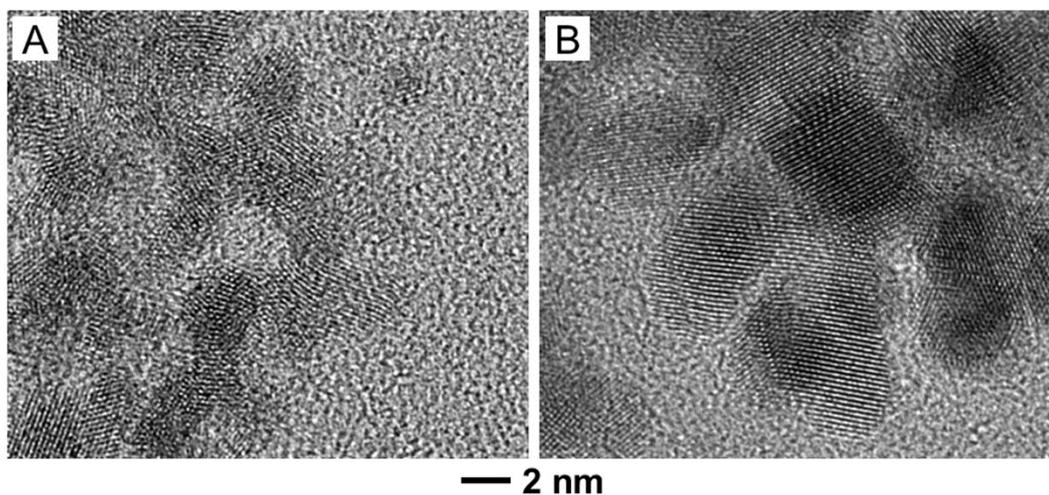


Fig. S1 TEM images of the sample obtained using the standard procedure, except the reaction was stopped at ~ 3 s after injecting an AA aqueous solution into the reaction mixture: (A) small Pd agglomerates, and (B) Pd nanostructures looked like initial state of the chestnut-bur-like Pd nanostructures, as marked dotted circles a and b in Fig. 2A, respectively.

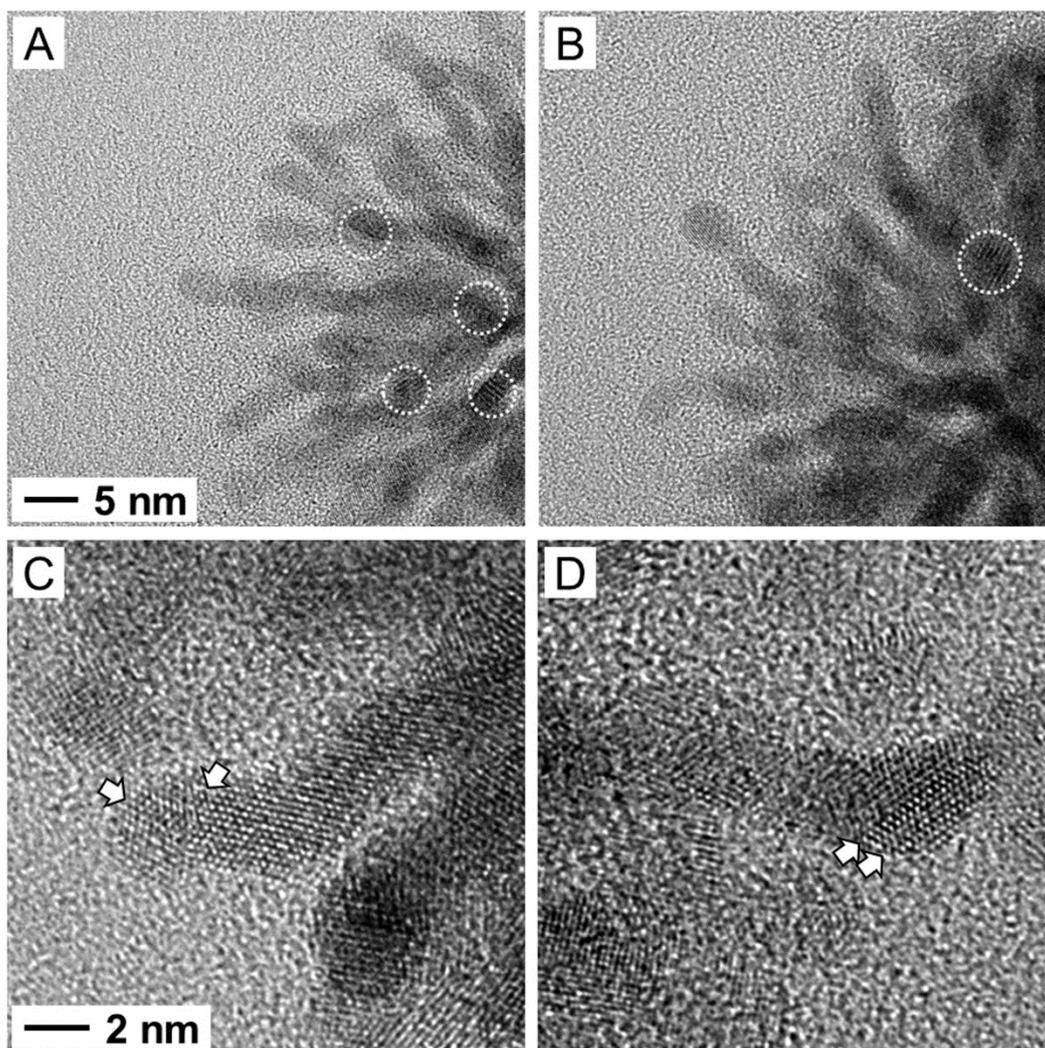


Fig. S2 TEM images recorded from the verge of chestnut-bur-like Pd nanostructures at different magnifications. The TEM images in the same row have identical magnifications, respectively. White dotted cycles and arrows indicate presence of stacking faults.

In the previous TEM studies on the Au nano-hexapods (ref. S1), the stacking faults and/or twin planes in the structure were observed as additional contrasts in the TEM images. This characteristic is similar to what has been reported for plate-like Ag nanostructures (ref. S2 and S3). The stacking faults and/or twin planes in the chestnut-bur-like Pd structures seem to be responsible for the additional contrasts shown in Fig. S2A and S2b.

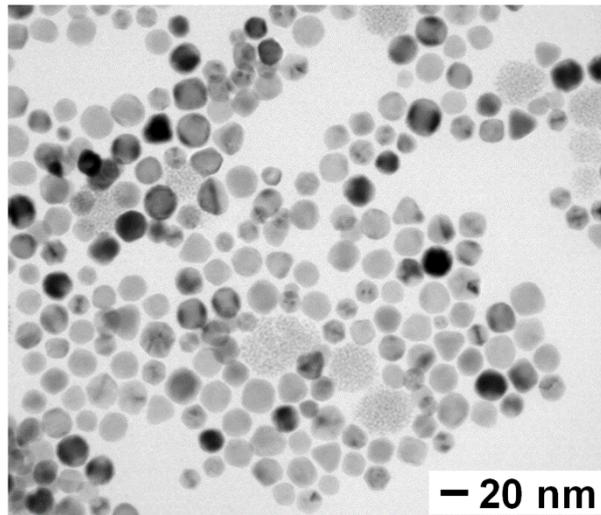


Fig. S3 TEM image of Pd nanostructures obtained using the standard synthesis, except with much larger amounts of CPC (500 mM).

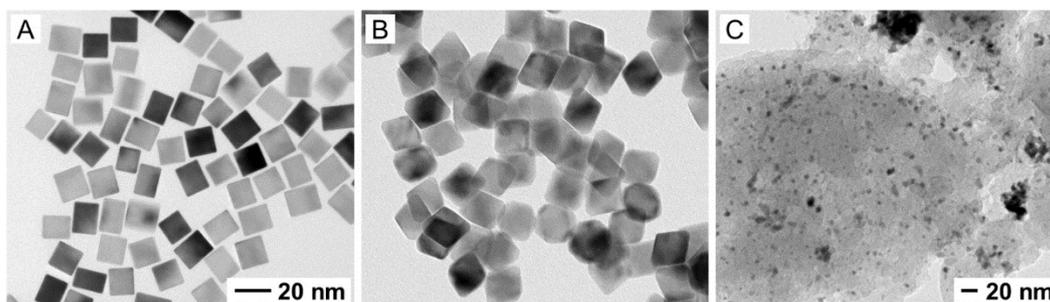


Fig. S4 TEM images of (A) Pd nanocubes, (B) Pd nanooctahedra, and (C) Pd/C used as nano catalysts toward ethanol oxidation reaction to compare with chestnut-bur-like Pd nanostructures. The Pd nanocubes with an average edge length of 14.0 ± 3.0 nm were prepared by just following the procedure described in ref. S4. The Pd nanooctahedra with an average edge length of 17.0 ± 3 nm were prepared by following the procedure described in the ref. S5 with a minor modification that a 60 mM CTAC aqueous solution was used instead of an 80 mM CTAC aqueous solution.

References

- S1 D. Y. Kim, T. Yu, E. C. Cho, Y. Ma, O O. Park, Y. Xia, *Angew. Chem. Int. Ed.*, 2011, **50**, 6328.
- S2 V. Germain, J. Li, D. Ingert, Z. L. Wang, M. P. Pileni, *J. Phys. Chem. B*, 2003, **107**, 8717.
- S3 Y. Xiong, A. R. Siekkinen, J. Wang, Y. Yin, M. J. Kim, Y. Xia, *J. Mater. Chem.*, 2007, **17**, 2600.
- S4 M. Jin, H. Liu, H. Zhang, Z. Xie, J. Liu, Y. Xia, *Nano Res.*, 2011, **4**, 83.
- S5 J. W. Hong, D. Kim, Y. W. Lee, M. Kim, S. W. Kang, S. W. Han, *Angew. Chem. Int.*

Ed., 2011, **50**, 8876.