

A -F F S H P /C A N F C A

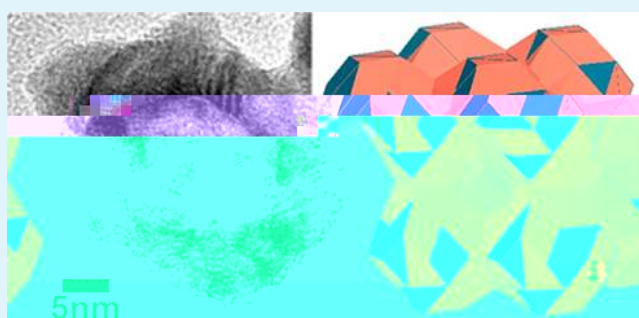
Chuangang Hu,^{†,§} Yuming Guo,^{†,§} Jinlong Wang,[‡] Lin Yang,^{*,†} Zongxian Yang,^{*,‡} Zhengyu Bai,[†]
Jie Zhang,[†] Kui Wang,[†] and Kai Jiang[†]

[†] School of Chemistry and Center for Nanostructured Materials, Beijing University of Aeronautics and Astronautics, Beijing 100191, China; [‡] School of Chemistry, Beijing University of Aeronautics and Astronautics, Beijing 100191, China; [§] Beijing Key Laboratory of Nanostructured Materials, Beijing University of Aeronautics and Astronautics, Beijing 100191, China; ^{*} Beijing Key Laboratory of Nanostructured Materials, Beijing University of Aeronautics and Astronautics, Beijing 100191, China

Supporting Information

ABSTRACT:

Herein, we report a novel hollow nanostructure of palladium/copper alloy (Pd/Cu) with a porous structure. The hollow nanostructure is synthesized by a two-step process. In the first step, a porous structure of copper is synthesized by a dealloying process. In the second step, the porous structure of copper is coated with a thin layer of palladium. The resulting hollow nanostructure of palladium/copper alloy (Pd/Cu) has a porous structure and a large surface area. The hollow nanostructure of palladium/copper alloy (Pd/Cu) shows excellent electrocatalytic activity for the formic acid oxidation reaction (FAOR) in a direct formic acid fuel cell (DFAFC). The electrocatalytic activity of the hollow nanostructure of palladium/copper alloy (Pd/Cu) is significantly higher than that of the commercial Pd/C catalyst. The electrocatalytic activity of the hollow nanostructure of palladium/copper alloy (Pd/Cu) is attributed to its porous structure and large surface area. The porous structure and large surface area of the hollow nanostructure of palladium/copper alloy (Pd/Cu) provide a large number of active sites for the FAOR. The electrocatalytic activity of the hollow nanostructure of palladium/copper alloy (Pd/Cu) is also attributed to the synergistic effect of palladium and copper. The synergistic effect of palladium and copper in the hollow nanostructure of palladium/copper alloy (Pd/Cu) enhances the electrocatalytic activity for the FAOR.



KEYWORDS: palladium/copper alloy, hollow nanostructure, surface energy difference, electrocatalytic activity, direct formic acid fuel cell, formic acid oxidation

Received: January 10, 2012
Accepted: January 10, 2012
Published: January 10, 2012

Received: January 10, 2012
Accepted: January 10, 2012
Published: January 10, 2012

Received: January 10, 2012
Accepted: January 10, 2012
Published: January 10, 2012

γ () (00) | s | ||
 | s | s | | s
 s. | s | | ||
 | s, | s | | || | s | | s |
 ss | | s | | || s |
 (00) | | || s |
 | s s s | s
 || s s. ,
 | s () | (). ,
 ||
 | s (| ,), ff
 (00) | || | s | s s s
) . s ff s (, (00)
 | || | s s.
 (00)
 | s | | || | s, ||
 | s | | | s | s
 || (s s
) . s ff s |
 s | |
 | s- / s s
 | | s | || () s
 | | () s
 | s s (), | |

| s | / / s s s s
 / / s s s fi |
 ff s s s, s,
 | s, | s | || ||
 s s s | | |
 s s | s | ||
 | | s (. ,) s fi | , s |
 | ff |
 | , | ff |
 s | s | s | d-
 | s s | || s, |
 s s s ,
 | s | s | /
 s s | s | | |
 | s | / s.
 s | s s , s

| s s | . 0. 0 s
 s s s s s
 / s s s / ,
 / s (0 . /).
 s | |
 | s -0.0 ,
 -0.0 / s.
 | s | s
 | / s.

s () / s s |
 / s. , s |
 -s / s s s

() , , . *Electrochem. Commun.* **2007**, *9*, - .
 () , , . *Electrochim. Acta* **2009**, *54*, - 0.

■ ASSOCIATED CONTENT

§ S I
 I s, / s
 I s, s I II
 s, s I s.
 s I s I I
 // s. s. /.

■ AUTHOR INFORMATION

C A
 * - I I (. .)
 (. . .).

A C
 § s s s II s s I
 s fi.s s.

N
 s I fi I s.

■ ACKNOWLEDGMENTS

s s fi II s I
 (0 , 0)
 I s s
 s (0)
 s I (00 000)
 s s s
 (0 000 , 00 00),
 s (0 -0)
 I s .

■ REFERENCES

- () II, . *Science* **2003**, *299*, - .
 () , , s , , II , . *Angew. Chem., Int. Ed.* **2010**, *49*, 0 - 0.
 () I , , , , . *Nature* **2001**, *410*, 0- .
 () s , , ss, , . *Nat. Mater.* **2007**, *6*, - .
 () , , , , , . *Angew. Chem., Int. Ed.* **2009**, *48*, - .
 () , , , , , . *J. Am. Chem. Soc.* **2010**, *132*, - .
 () , , , , , . *Electrochem. Commun.* **2011**, *13*, - .
 () , , , , , . *Nat. Mater.* **2005**, *4*, - .
 () s , , , , . *J. Am. Chem. Soc.* **2005**, *127*, 0 - 0 .
 (0) , , , , , . *Chem. Commun.* **2011**, *47*, - .
 () , , , , , , . *Angew. Chem., Int. Ed.* **2004**, *43*, 0- .
 () , , , , , , . *J. Power Sources* **2009**, *186*, - .
 () , , , , , . *Electrochem. Commun.* **2010**, *12*, - .
 () s , , II , . *Surf. Sci.* **1977**, *62*, - .
 () - II , , , . *Phys. Rev. B* **2009**, *80*, 0 .
 () , , , , , . *Angew. Chem., Int. Ed.* **2009**, *48*, 0 - .