Supporting Information

Pt fibers with stacked donut-like mesospace by assembling Pt nanoparticles: Guided deposition in physically confined self-assembly of surfactants

Yusuke Yamauchi,^a* Azusa Takai,^b Tomota Nagaura,^{c,d} Satoru Inoue,^{c,d} and Kazuyuki Kuroda^b*

- a World Premier International (WPI) Research Center, International Center for Materials Nanoarchitectonics (MANA), National Institute for Materials Science (NIMS), Namiki 1-1, Tsukuba, Ibaraki 305-0044, JAPAN.
- b Department of Applied Chemistry, Faculty of Science & Engineering, Waseda University,
 Ohkubo 3-4-1, Shinjuku-ku, Tokyo 169-8555, JAPAN.
- c Nano Ceramics Center, National Institute for Materials Science (NIMS), Namiki 1-1, Tsukuba, Ibaraki 305-0044, JAPAN.
- d Doctoral Program in Materials Science and Engineering, Graduate School of Pure and Applied Sciences, University of Tsukuba, Tennodai 1-1-1, Tsukuba, Ibaraki 305-8577, JAPAN.

E-mail: YAMAUCHI.Yusuke@nims.go.jp (YY) and kuroda@waseda.jp (KK)

Preparation of PAAM with various pore sizes:

A pure aluminum sheet (99.99 %, Wako Pure Chemical Industry, Ltd.) and a carbon electrode were used as working and counter electrodes, respectively. Then, an anodization process was carried out in a 2 vol. % phosphoric acid or 0.3 M oxalic acid solution (Kanto Chemical Co., Inc.) at 10 °C. The anodizing voltage of 40-150 V was applied through a high-output DC power supply (PVS 600-2, Kikusui Electronics Corp.). The pore sizes were controllable by changing the anodizing voltage. To maintain a low constant temperature, a large water bath attached with a cooling circulator (Cool-Line, CLH 300) was used. After the anodization, the specimen was dipped in a 5 vol. % phosphoric acid solution at 30 °C for 0~40 min to further widen the pores in the PAAM.

Figures:



Introduction of precursor solutions Reduction of Pt species

Figure S1 Photographs of (a) PAAM, (b) PAAM with LLC, and (c) PAAM after Pt deposition.



Figure S2 (Left image) Cross-sectional SEM image of the PAAM after the Pt deposition. (Right image) EDS mapping image of the deposited Pt. In the present vapor infiltration method of the reducing agent, the deposition of Pt started from the outer surface of PAAM. The rod length is controllable by changing the reduction time, though in this study we fixed the reduction time for 15 h before the full reduction of the Pt species. Scale bar is 30 μ m.



Figure S3 (a and b) 2D-XRD patterns of LLC mesophases (a) within the PAAM and (b) a flat glass substrate. (c) The 2D-XRD geometry and the proposed LLC mesophase structure within the PAAM. The (0-1) spot is not observable by a beam stopper.



25 nm





Figure S5 SEM images of the Pt fibers prepared with PAAM (pore diameter 50~60 nm). (c) Highly magnified image. Connection of nanoparticles like a necklace is observable on the top-surface of the fiber.



Figure S6 3D-imaging of the Pt fibers prepared with PAAM (pore diameter 50~60 nm).



Figure S7 (a and b) BF-STEM images of the Pt fibers prepared with PAAM (pore diameter 30~50 nm). (c) Cross-sectional SEM image. The circular stripes are observable.