Supporting Information

Synthesis and Delamination of Layered Manganese Oxide Nanobelts

Zhaoping Liu, Renzhi Ma, Yasuo Ebina, Kazunori Takada, and Takayoshi Sasaki* Nanoscale Materials Center, National Institute for Materials Science (NIMS), Namiki 1-1, Tsukuba, Ibaraki 305-0044, Japan



Figure S1. TG-DTA curves of as-prepared K-birnessite sample. The weight loss (7.8%) below 250 $^{\circ}$ C is due to dehydration. The weight loss above 800 $^{\circ}$ C is ascribed to the decomposition of MnO₂ layers.



Figure S2. (a) XRD pattern and (b) SEM image of the birnessite sample obtained via a reaction between $MnCl_2$ and $KMnO_4$ in the concentrated KOH solution (without the hydrothermal treatment). The XRD pattern indicates the presence of a small amount of hausmannite impurity as designated by triangles.



Figure S3. SEM images of the samples prepared with various KOH concentrations: (a) 3 M, (b) 6 M, and (c) 9 M.



Figure S4. SEM images of the samples prepared with different Mn²⁺/MnO₄⁻ ratios: (a) 1.5, (b) 1.8, (c) 1.9, (d) 1.95, (e) 2.0, (f) 2.2, (g) 2.5, and (h) 3.0.



Figure S5. TG-DTA curves of as-prepared H-birnessite sample. The weight loss (12.0%) below 300 $^{\circ}$ C is due to the removal of the majority of interlayer water. The weight loss (9.0%) in the range of 300-900 $^{\circ}$ C is ascribed to the removal of the remaining interlayer water and the decomposition of MnO₂ layers into Mn₂O₃. The weight loss (3.1%) above 900 $^{\circ}$ C corresponds to the conversion of Mn₂O₃ to Mn₃O₄.



Figure S6. Tapping-mode AFM image of the MnO_2 nanosheets exfoliated by the treatment with TBAOH under agitated shaking (170 rpm, 10 days).



Figure S7. XRD patterns of various birnessite samples recovered from the highly swollen structure by treating with HCl, LiCl, KCl, CoCl₂, Eu(NO₃)₃, and dodecyl trimethylammonium bromide (DTAB) aqueous solutions, respectively.



Figure S8. SEM images of birnessite samples recovered from the highly swollen structures by treating with aqueous solutions of (a) HCl and (b) KCl.



Figure S9. TEM image of belt-like nanosheets with lengths of several micrometers.