Electronic Supplementary Information

Bottom-up synthesis of titanophosphate nanosheets by the aqueous solution process

Takayuki BAN*, Keito ASANO, Chika TAKAI, and Yutaka OHYA

Department of Chemistry and Biomolecular Science, Gifu University, Yanagido 1-1, Gifu 501-1193, Japan

Corresponding Author [*]: Takayuki BAN ban@gifu-u.ac.jp

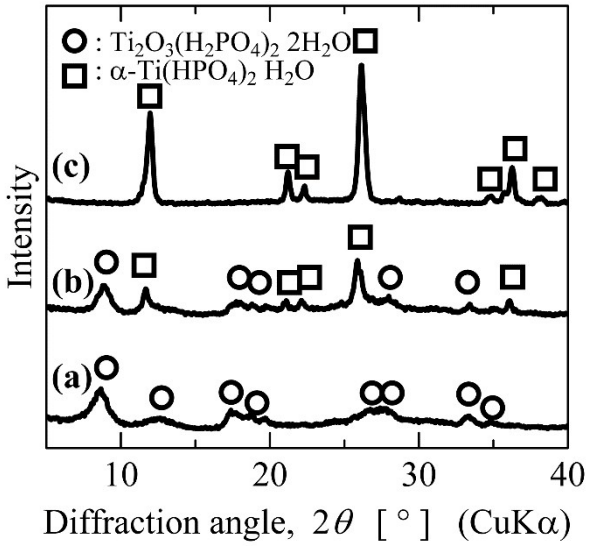

Figure S1 XRD patterns of the powders prepared by heating the mixtures of TIP and H_3PO_4 with H_3PO_4 / TIP molar ratios of (a) 1, (b) 10, and (c) 20 at 100 °C.

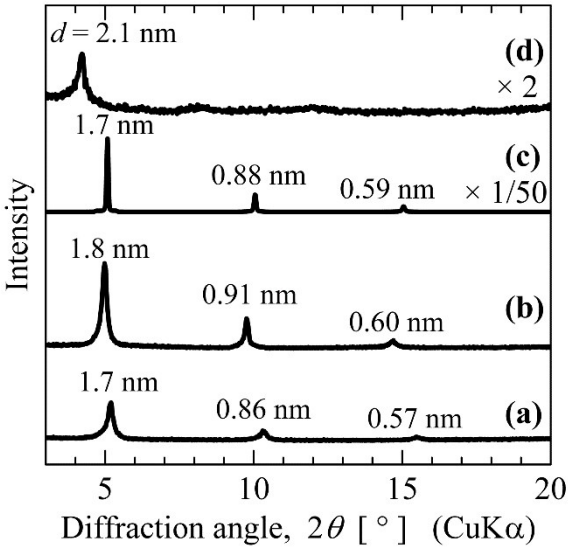

Figure S2 XRD patterns of the thin films fabricated by evaporating titanophosphate nanosheet sols on a glass substrate. The titanophosphate nanosheet sols were prepared by heating the mixtures of TIP, H_3PO_4, and NR_4OH with a molar ratio of TIP / H_3PO_4 / NR_4OH = 1 / 1 / 2.2 at 80 °C. The used NR_4OH was (a) TMAOH, (b) TEAOH, (c) TPAOH, and (d) TBAOH.

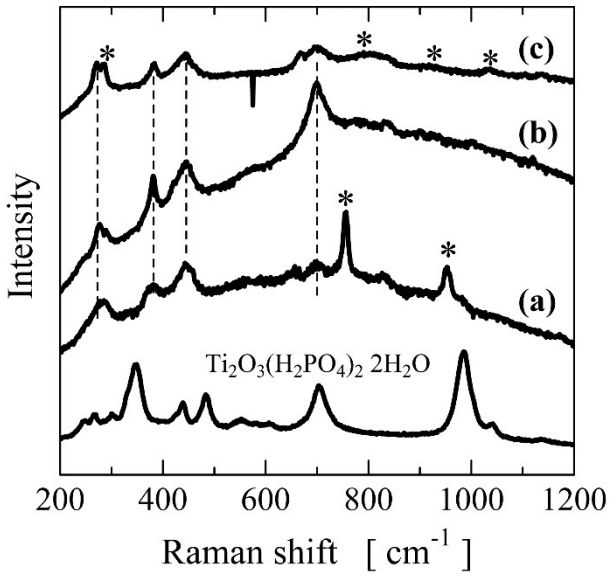

Figure S3 Raman spectra of the titanophosphate nanosheets prepared by evaporating titanophosphate nanosheet sols and then washed with 2-PrOH. The titanophosphate nanosheet sols were prepared by heating the mixtures of TIP, H_3PO_4, and NR_4OH with a molar ratio of TIP / H_3PO_4 / NR_4OH = (a, b) 1 / 1 / 2 and (c) 1 / 1 / 2.5 at 80 °C. The used NR_4OH was (a) 2.8 M TMAOH, (b) 1.4 M TEAOH, and (c) 0.5 M TPAOH. The marks * are assigned to NR_4^+ ions. For comparison, the Raman spectrum of layered titanium phosphate $Ti_2O_3(H_2PO_4)_2$ $2H_2O$ is also shown.

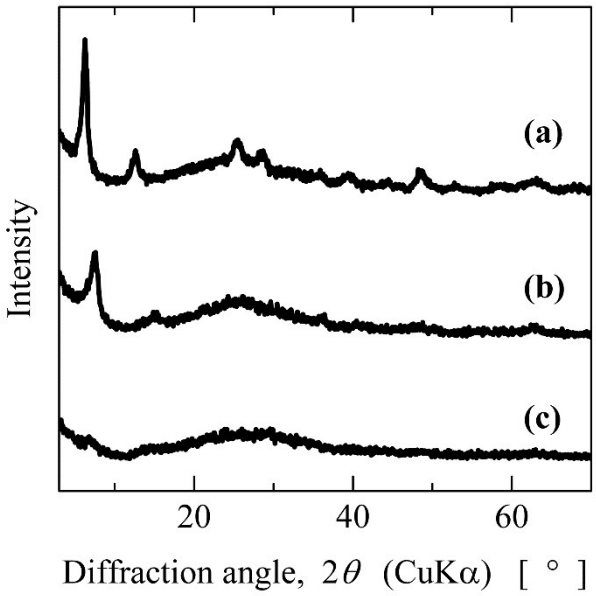

Figure S4 XRD patterns of the powders prepared from the titanophosphate nanosheet sols synthesized from the sols (a) prepared at TIP / H_3PO_4 / TPAOH = 1 / 1 / 2.5 using 0.5 M TPAOH and prepared at TIP / H_3PO_4 / TEAOH = 1 / 1 / (b) 2.0 and (c) 2.2 using 1.4 M TEAOH. The sample (a), (b), and (c) correspond to O (large), Δ (medium), and × (small), respectively.

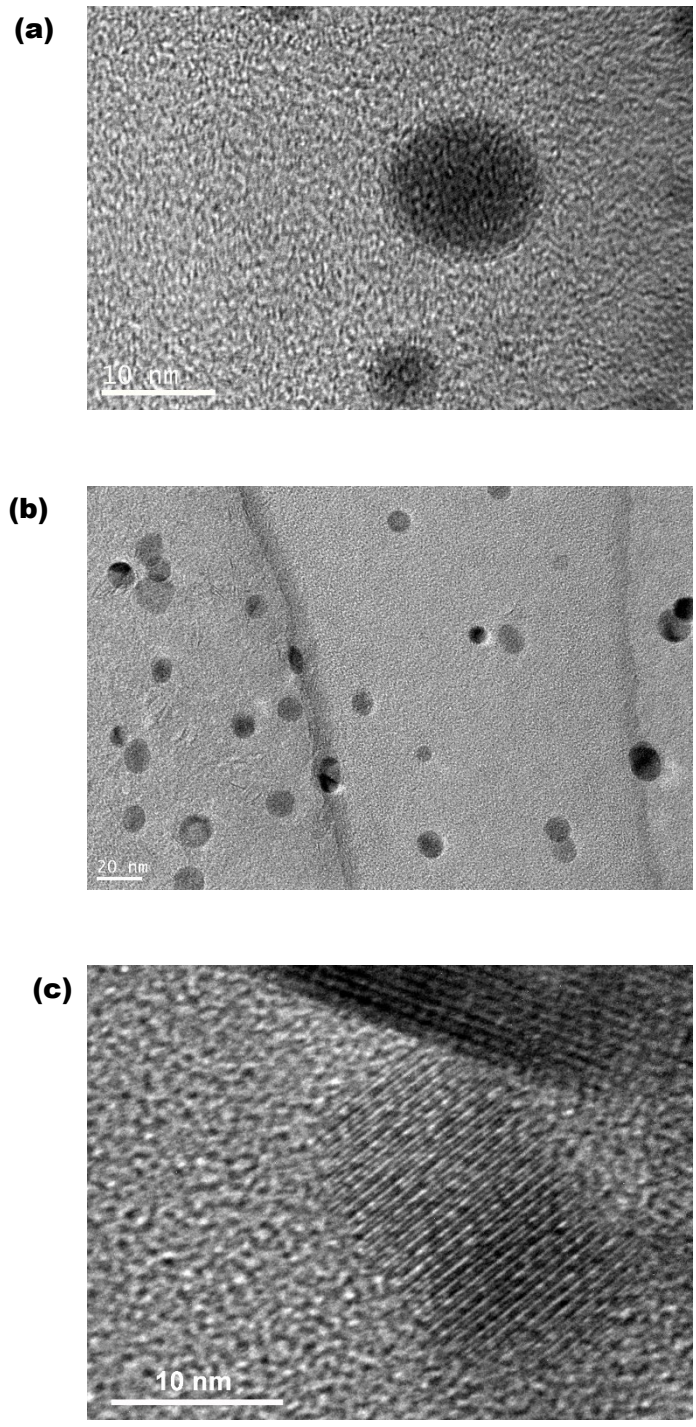

Figure S5 TEM images of the titanophosphate nanosheets synthesized (a) from the aqueous mixture with a molar ratio of TIP / H_3PO_4 / TPAOH = 1 / 1 / 2.2 in very weakly basic aqueous sols with a pH value of about 9, (b) from the aqueous mixture with a molar ratio of TIP / H_3PO_4 / TEAOH = 1 / 1 / 2, which was prepared by using 1.4 M TEAOH solution, and (c) from the aqueous mixture with a molar ratio of TIP / H_3PO_4 / TBAOH = 1 / 1 / 2, which was prepared by using 1.5 M TBAOH solution.

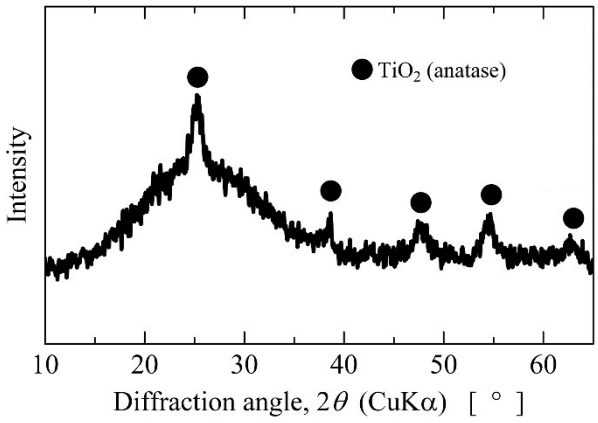

Figure S6 XRD pattern of the precipitates formed by adding titanophosphate nanosheet powder including an amorphous phase to copper acetate aqueous solution.