Electronic Supplementary Material (ESI) for CrystEngComm


# Electronic Supplementary Information

## Fabrication of nanoporous $MTiO_3$ (M=Pb, Ba, Sr) perovskite array films with unprecedented high structural regularity

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## Experimental Procedures

*Electropolishing and two step anodization to fabricate the nanoporous titanate*

First, bare Ti foil (1x1.5cm, 0.25mm thickness) was cleaned by ultrasonication in acetone, isopropyl alcohol, and ethanol. The electropolishing of cleaned Ti foil was carried in a solution with perchloric acid, butanol, and ethanol at 20V for 5min below -20℃. The two-step anodization process was performed in a two-electrode electrochemical cell equipped with Ti foil (anode) and platinum mesh (cathode) under constant voltage. The first potentiostatic anodization process was performed at 60V for 3h at 20℃ in a solution of 0.3wt% $NH_4F$ and 2 vol% deionized water dissolved in ethylene glycol. As-prepared first anodic $TiO_2$ was removed mechanically. The second anodization was carried on the textured Ti surface at 60V for 30min at 20℃ in the same solution.

*Hydrothermal treatment to obtain nanoporous $MTiO_3$ (M=Pb, Ba, Sr) perovskite arrays*

The hydrothermal treatment was carried out in a Teflon-vessel fitted stainless steel reactor containing 0.002M Pb acetate trihydrate, 0.05M Ba hydroxide oxtahydrate, or 0.05M Sr hydroxide dissolved in 80ml $CO_2$-free water under $N_2$ atmosphere. The reactor was placed in a convection oven at 280℃ ($PbTiO_3$), 200℃ ($BaTiO_3$), and 200℃ ($SrTiO_3$), for 6h without disruption. After the reaction, as-prepared thin film was washed with deionized water and dried in a vacuum oven.

*Sample Characterization*

The Top surface and cross sectional morphology images were obtained by FE-SEM (JEOL JSM-7401F). The crystal structure of the sample was determined by X-ray diffraction (XRD, PANalytical X´Pert diffractometer with an X´Celerator detector) with Cu Kα radiation.

**Perovskite titanate films reported in the literature[1-3]**

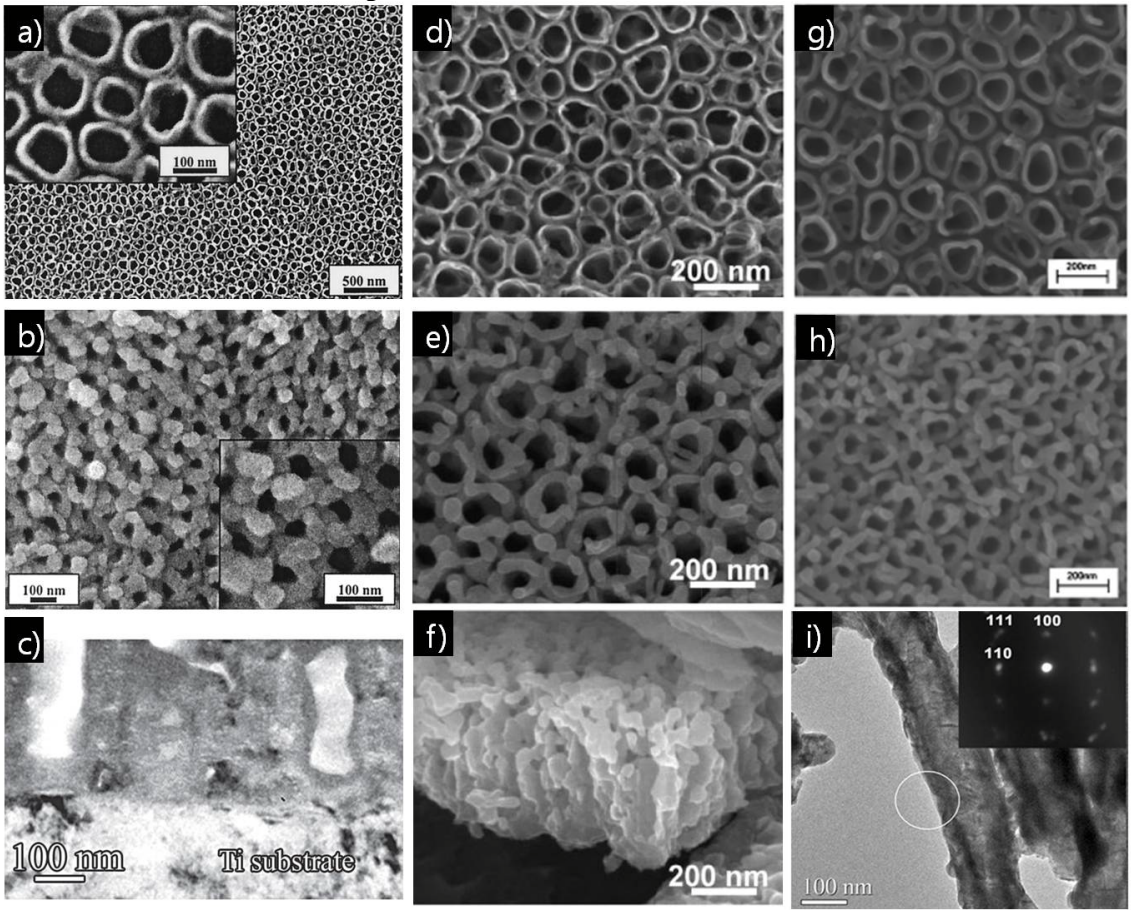


**Figure S1**. SEM images: (a) Anodic $TiO_2$ nanotubes[1], and (b,c) $BaTiO_3$ nanotubes by hydrothermal synthesis of anodic $TiO_2$ nanotubes shown in (a): (d) Anodic $TiO_2$ nanotubes[2], and (e,f) $PbTiO_3$ nanocellular structure by electrodeposition and thermal conversion of (d): (g) Anodic $TiO_2$ nanotubes[3], and (h,i) $PbTiO_3$ nanotubes by hydrothermal method of anodic $TiO_2$ nanotubes shown in (g). c, f and i are cross sectional SEM images.

[1] Padture, N. P.; Wei, W. *J. Am. Ceram. Soc*. 2003 86 2215–7.

[2] Macak, J. M.; Zollfrank, C.; Rodriguez, B. J.; Tsuchiya, H.; Alexe, M.; Greil, P.; Schmuki, P. *Adv. Mater*. 2009 21 3121-3125.

[3] Yang, Y.; Wang, X.; Zhong, C.; Sun, C.; Yao, G.; Li, L. *J. Am. Ceram. Soc*. 2008 91 3388-3390.