Supporting Information

In situ TEM Observation of the Electrochemical Lithiation of N-doped Anatase

TiO₂ Nanotubes as Anodes for Lithium-ion Batteries

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Figure S1. EELS spectrum for N-doped and pristine $a-TiO_2$ nanotubes. The estimation of N and O content change was performed by using EELS quantifications in the Digital Micrograph, a software package provided through Gatan. Hydrogenic model for the O K-edge and the N K-edge, and Hartree-Slater atomic model for the Ti L-edge were used to calculate the energy differential cross-sections, respectively.¹



Figure S2. Nyquist plots for TiO_2 nanotube arrays under the open-circuit potential as well as the corresponding equivalent circuit to fit the plots.



Figure S3. Bright-field TEM images of an individual TiO₂ nanotube before and after complete lithiation displaying clear volume expansion: (a, b) is pure TiO₂ nanotube reprinted with permission from previous results published by Gao *et al. Chem. Mater.*, 2014, **26**, 1660-1669. Copyright **2014** American Chemical Society.² (c, d) N-doped TiO₂ nanotube before and after lithiation, respectively, observed in this work

References:

[1] R. F. Egerton, *Electron Energy Loss Spectroscopy in the Electron Microscope*, Springer US, 2011, ISBN 978-1-4419-9583-4.

[2] Q. Gao, M. Gu, A. Nie, F. Mashayek, C. Wang, G. M. Odegard, R. Shahbazian-Yassar, *Chem. Mater.*, 2014, 26, 1660-1669.