

## Electronic Supplementary Information (ESI)

# Hierarchical macrochanneled layered titanates with “house-of-cards”-type titanate nanosheets and their superior photocatalytic activity

Thuy-Duong Nguyen-Phan,<sup>a</sup> Eun-Suok Oh,<sup>a</sup> Manish Chhowalla,<sup>b</sup> Tewodros Asefa,<sup>\*c,d</sup>  
and Eun Woo Shin<sup>\*a</sup>

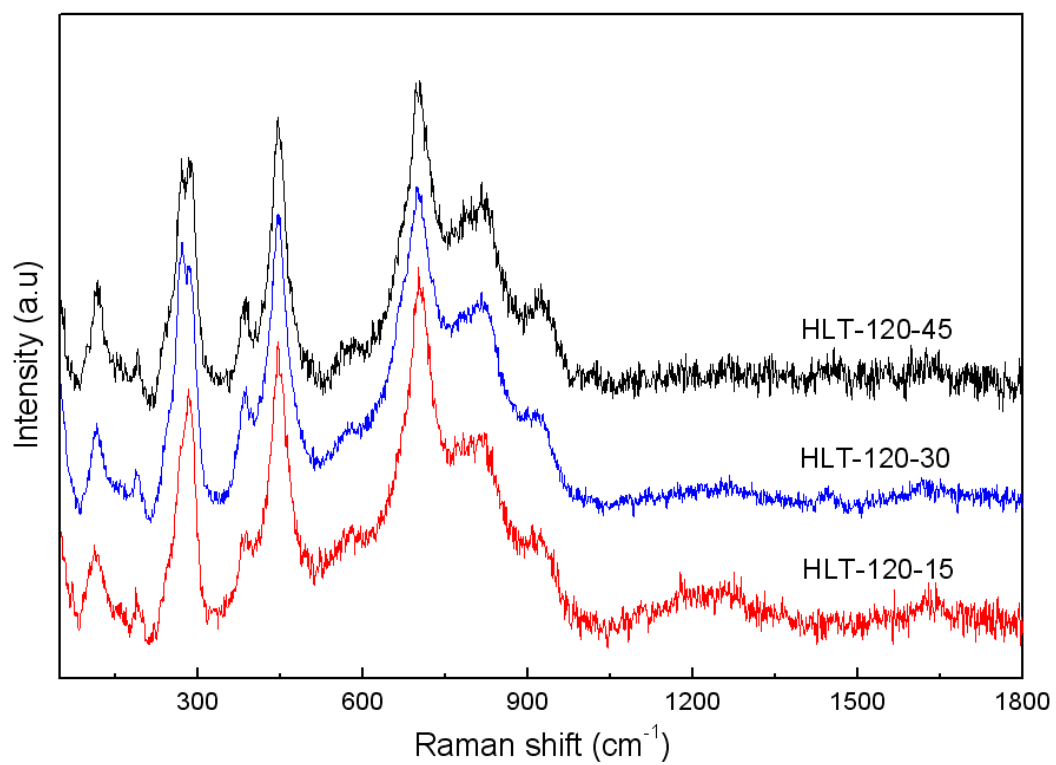
<sup>a</sup> School of Chemical Engineering and Bioengineering, University of Ulsan, Daehakro 93, Nam-gu, Ulsan 680-749, South Korea. Fax: +82-52-259-1689; Tel.: +82-52-259-2253; E-mail: ewshin@mail.ulsan.ac.kr

<sup>b</sup> Department of Materials Science and Engineering, Rutgers, The State University of New Jersey, 607 Taylor Road, Piscataway, NJ 08854, USA

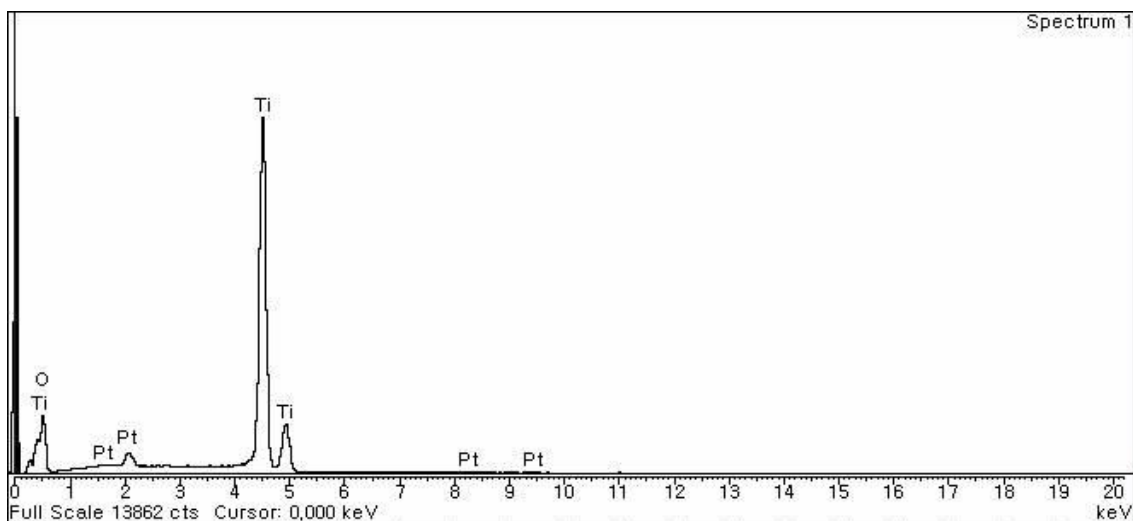
<sup>c</sup> Department of Chemistry and Chemical Biology, Rutgers, The State University of New Jersey, 610 Taylor Road, Piscataway, NJ 08854, USA. Fax: +1 732 4455312; Tel: +1 8484452970; E-mail: tasefa@rci.rutgers.edu

<sup>d</sup> Department of Chemical and Biochemical Engineering, Rutgers, The State University of New Jersey, 98 Brett Road, Piscataway, NJ 08854, USA.

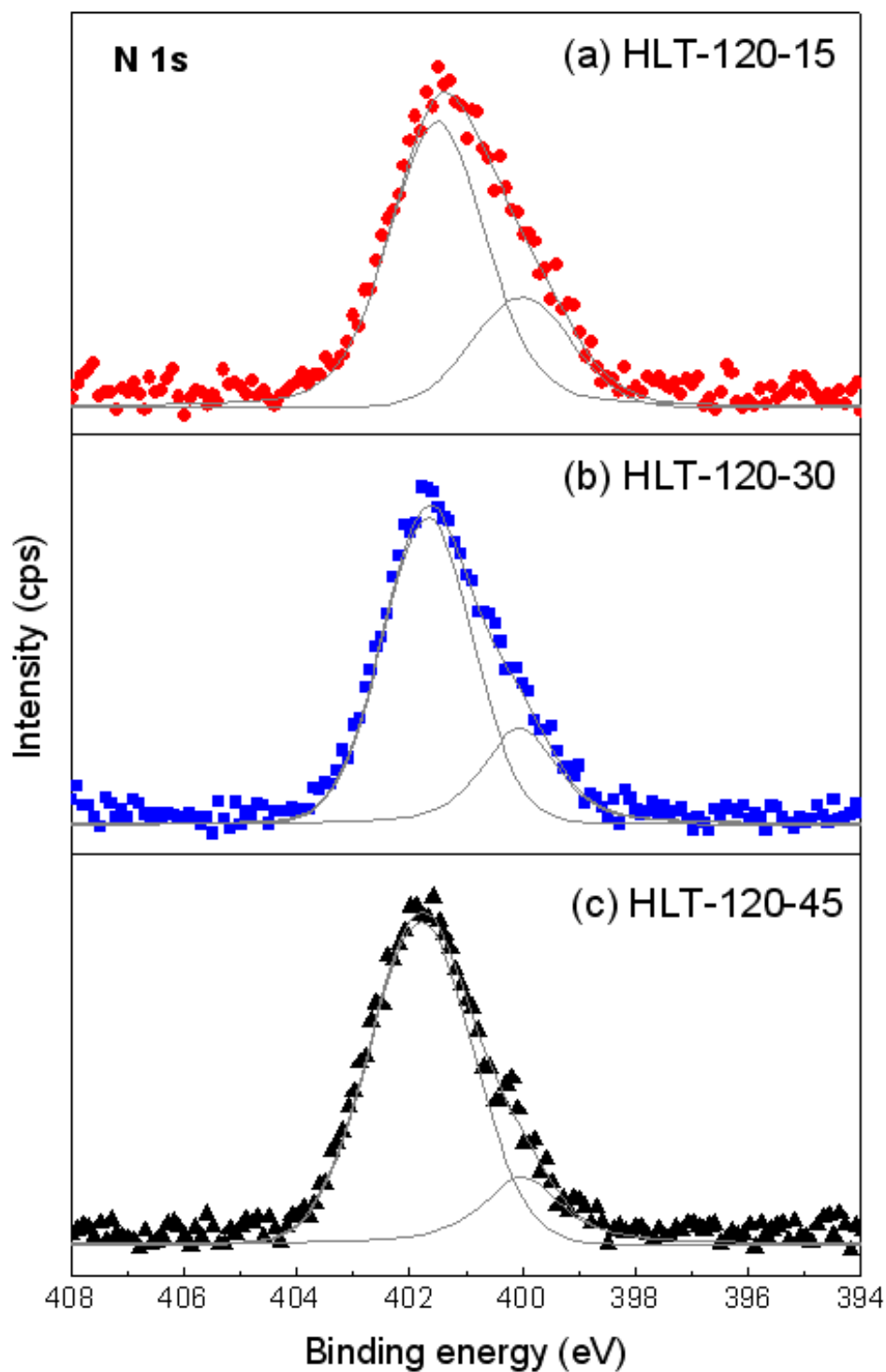
### Supplementary figures



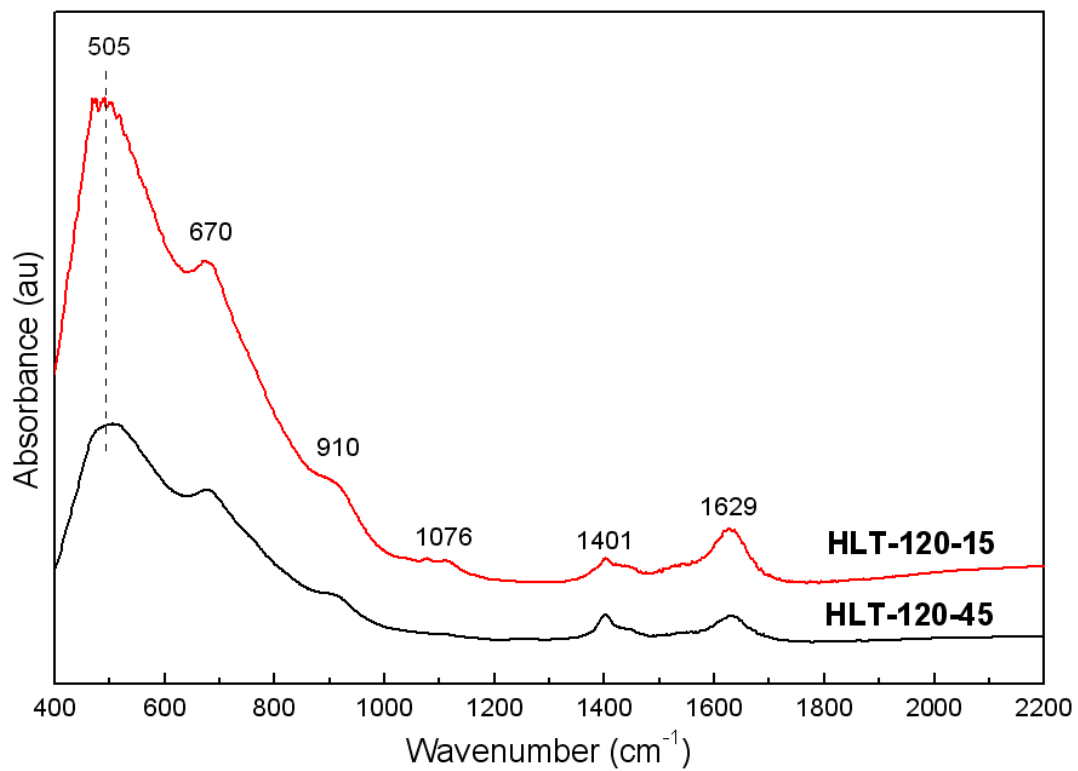
**Figure S1.** FT-Raman spectra of HLT-120-15, HLT-120-30 and HLT-120-45.



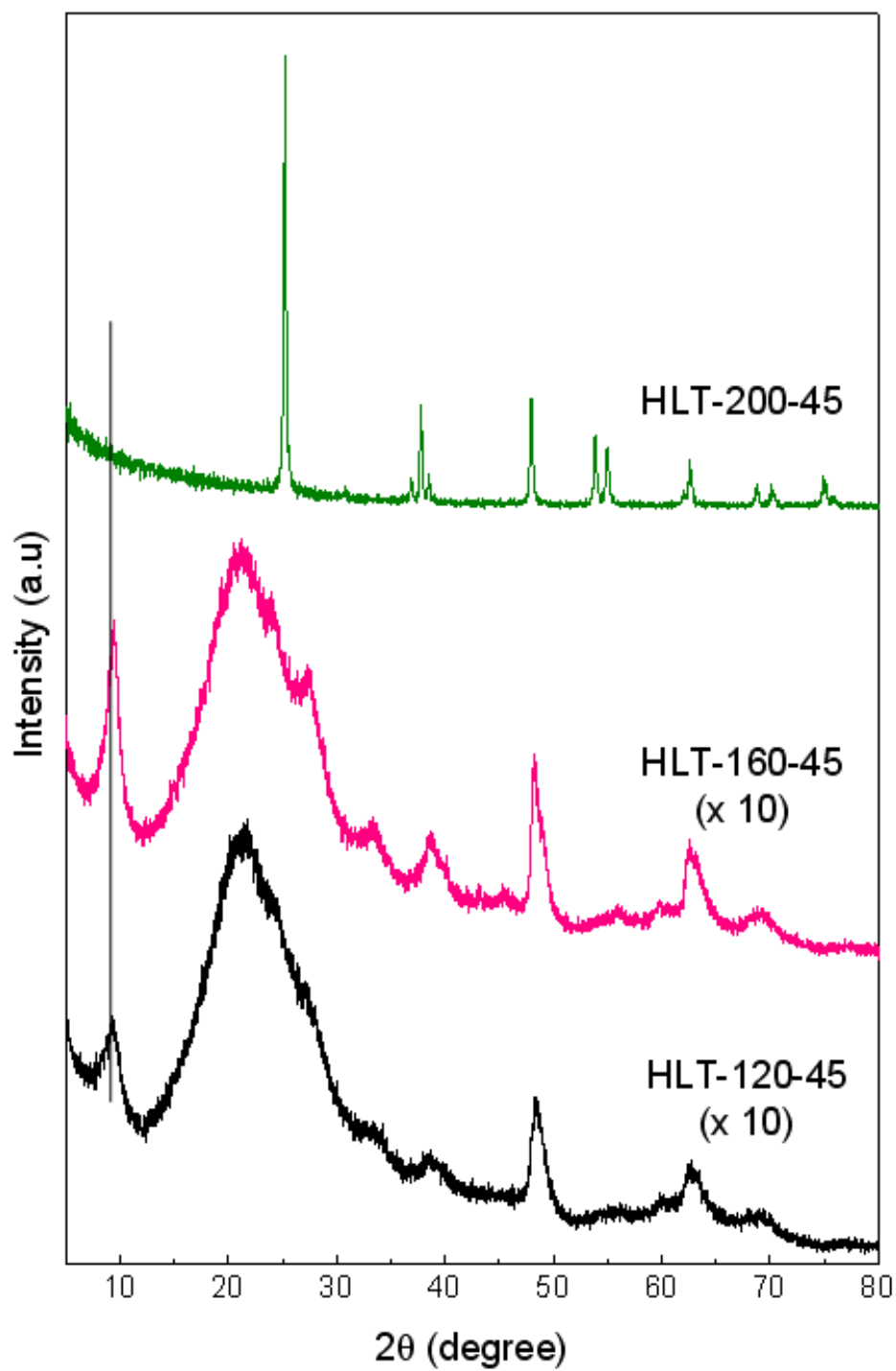
**Figure S2.** Representative FE-SEM/EDX spectrum of HLT-120-15 sample, indicating the presence of 56.4 wt. % of Ti and 43.7 wt. % of O species.



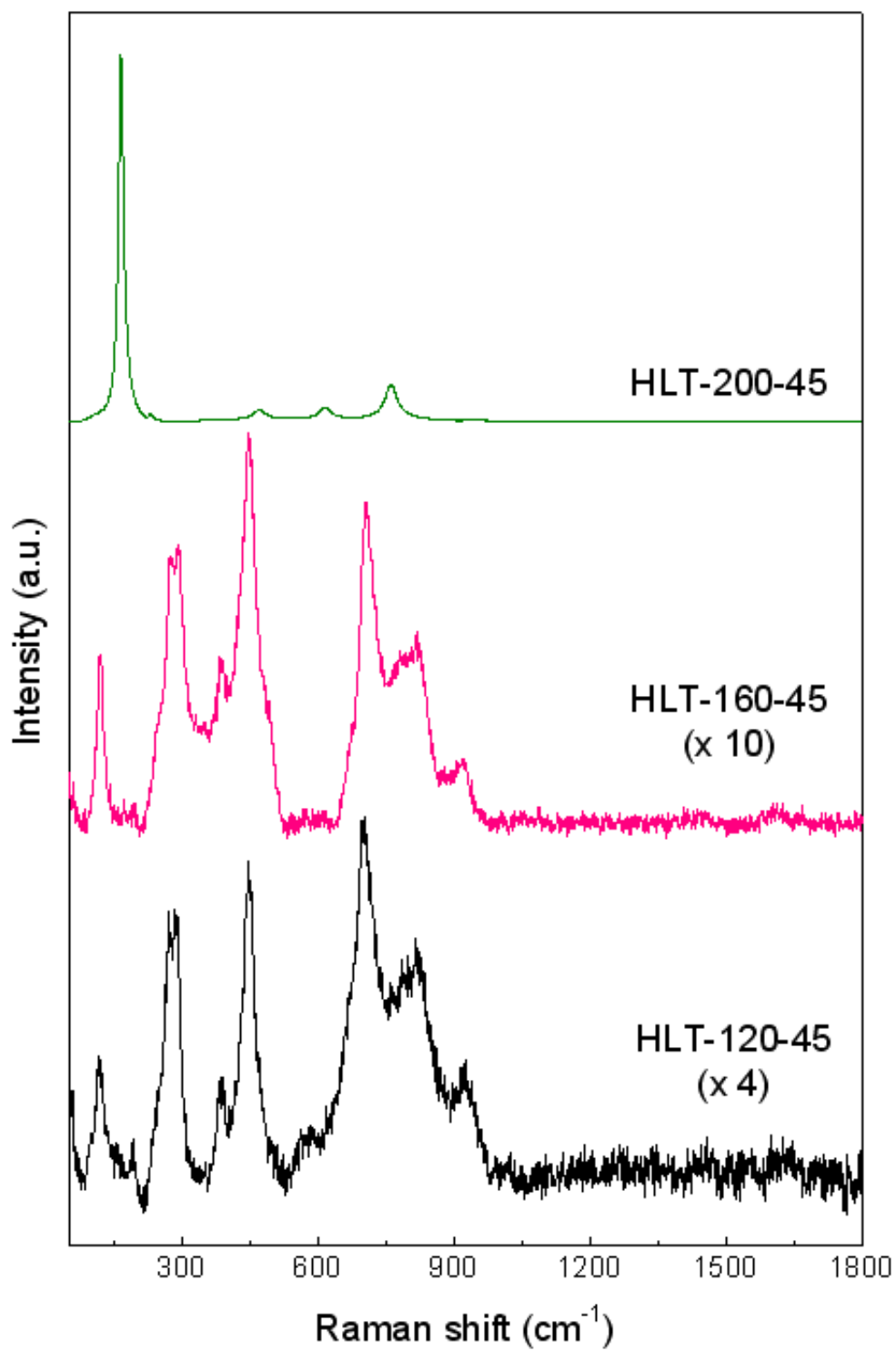
**Figure S3.** XPS N1s spectra of HLT-120-t samples that were obtained *via* solvothermal treatment for different reaction times shown in the labels above.



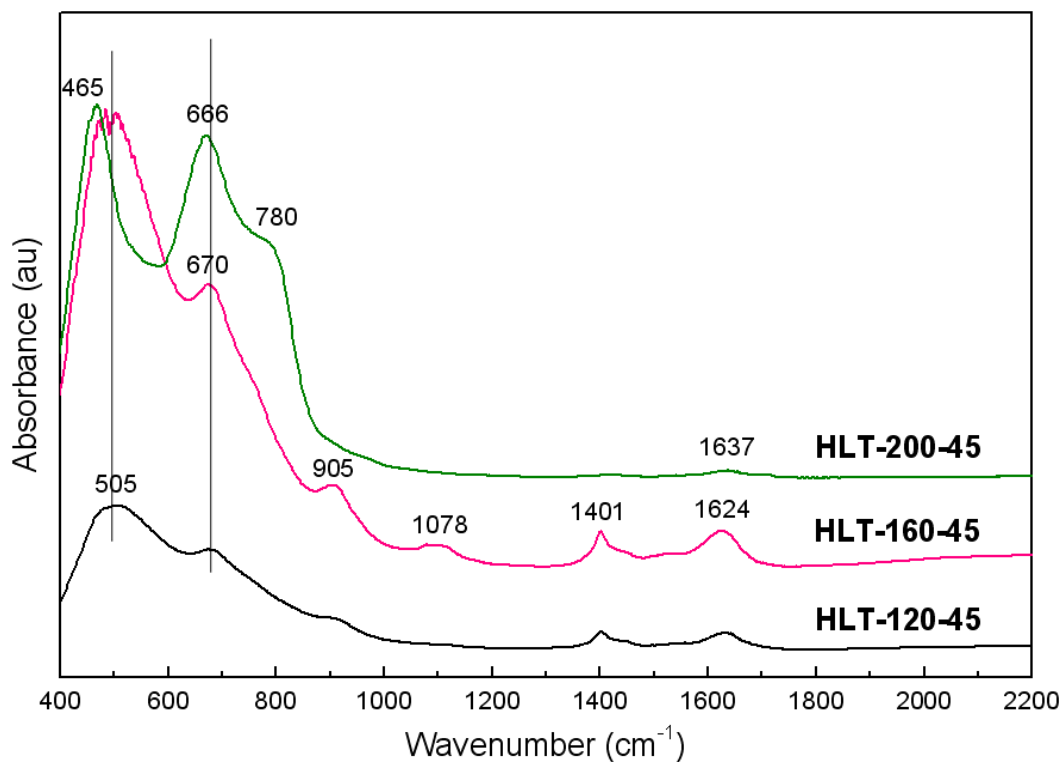
**Figure S4.** FT-IR spectra of two different HLT-120-t materials.



**Figure S5.** Powder XRD patterns of HLT architectures prepared at 120, 160 and 200°C after 45 h.

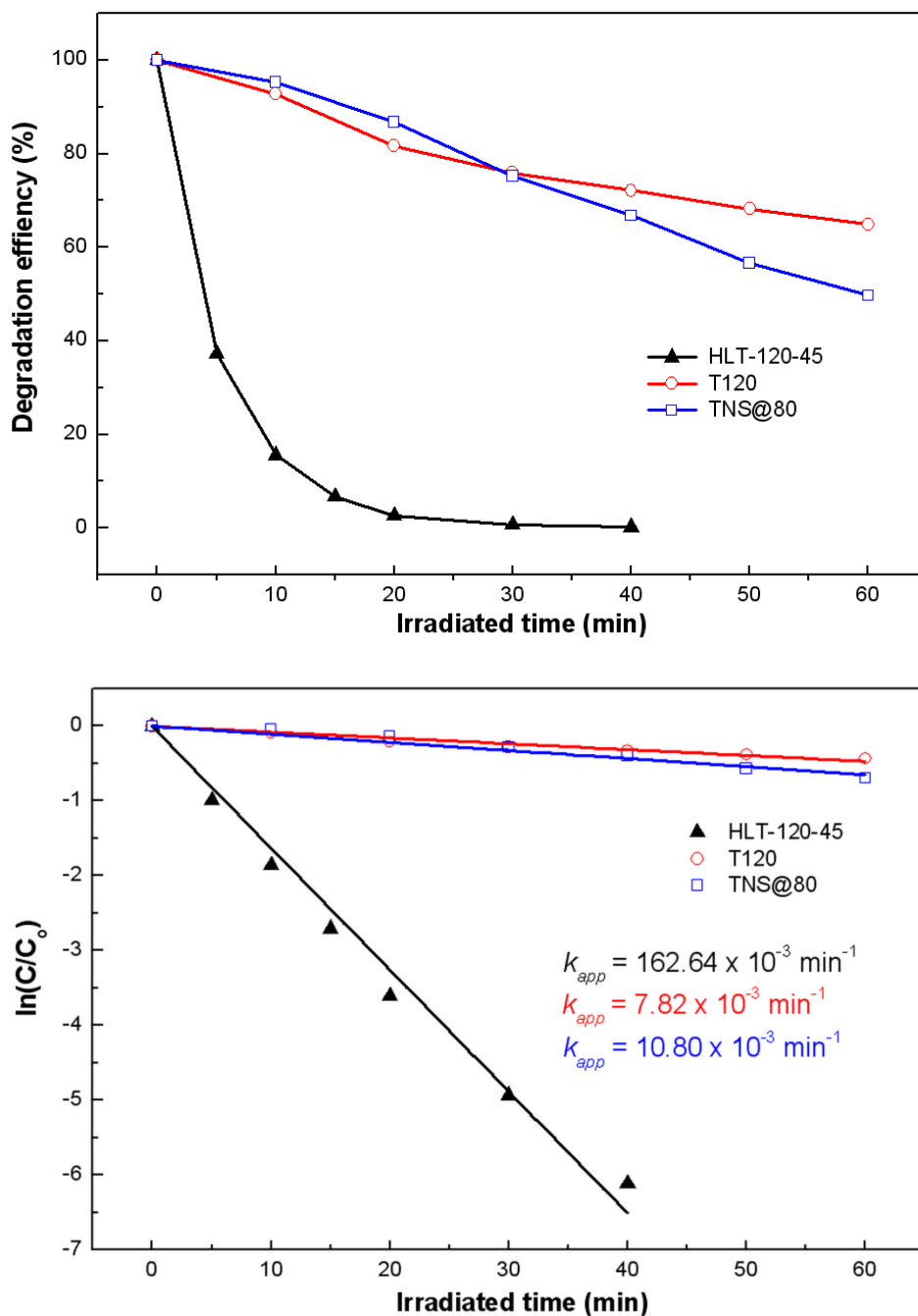


**Figure S6.** FT-Raman spectra of HLT-120-45, HLT-160-45 and HLT-200-45.

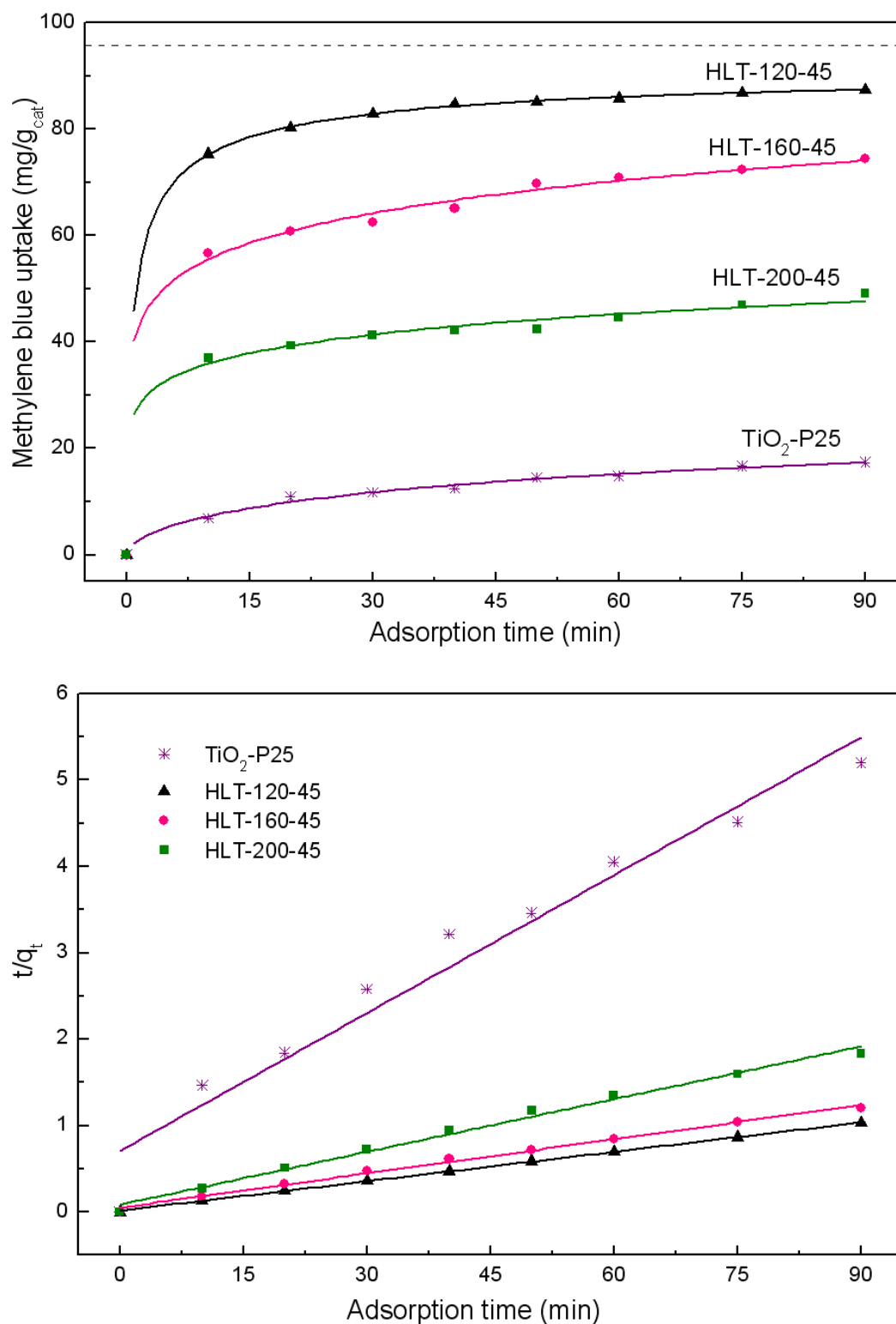


**Figure S7.** FT-infrared spectra of different HLT-T-120 materials synthesized with different solvothermal times.

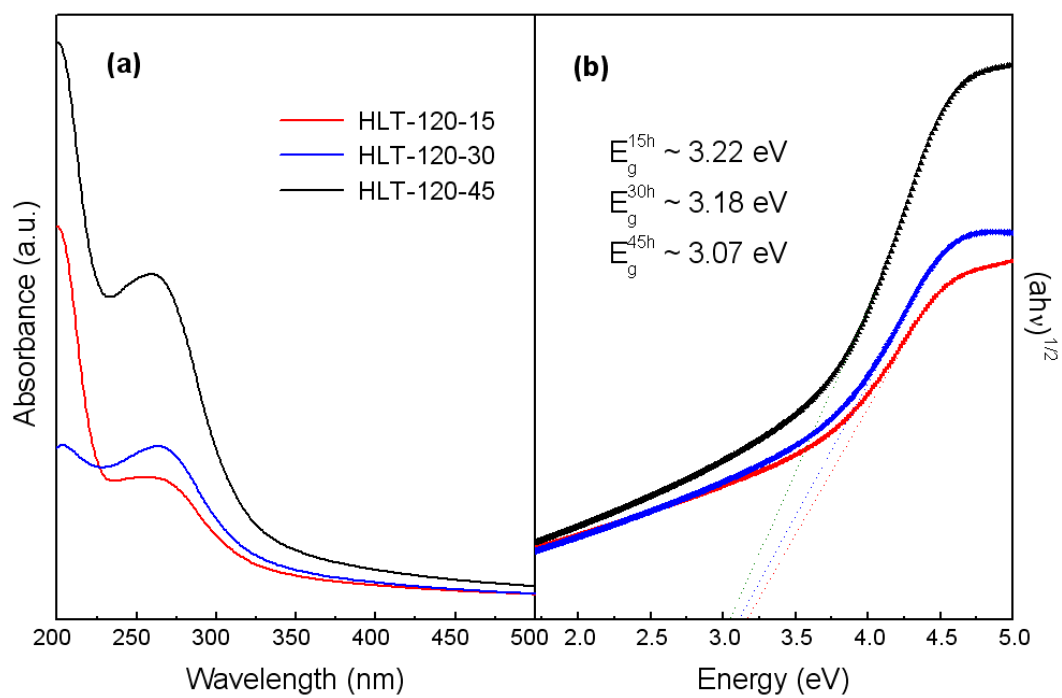




**Figure S8.** (a) Photocatalytic degradation of methylene blue (MB) over HLT-120-45, hierarchical T120 (described in T.-D. Nguyen-Phan, E. J. Kim, S. H. Hahn, W. J. Kim and E. W. Shin, *J. Colloid. Interface Sci.*, 2011, **356**, 138-144) and TNS@80 (reported in T.-D. Nguyen-Phan, V. H. Pham, E. J. Kim, E.-S. Oh, S. H. Hur, J. S. Chung, B. H. Lee and E. W. Shin, *Appl. Surf. Sci.*, 2012, **258**, 4551-4557); (b) apparent first-order linear transformation  $\ln(C/C_0) = f(t)$ . The catalyst concentration was  $0.1 \text{ gL}^{-1}$  and initial MB concentration was  $3 \times 10^{-5} \text{ M}$ .



**Figure S9.** (a) Uptake of methylene blue vs. adsorption time over commercial TiO<sub>2</sub> (P25) and HLT-T-45 materials and (b) the corresponding pseudo-second-order kinetic plots.



**Figure S10.** (a) UV-Vis-DRS spectra and (b) plots of  $(Ah\nu)^2$  versus photon energy  $(h\nu)$  of HLT-120-t samples.