Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

Tuning the fluorescence intensity and stability of porous silicon nanowires via mild thermal oxidation

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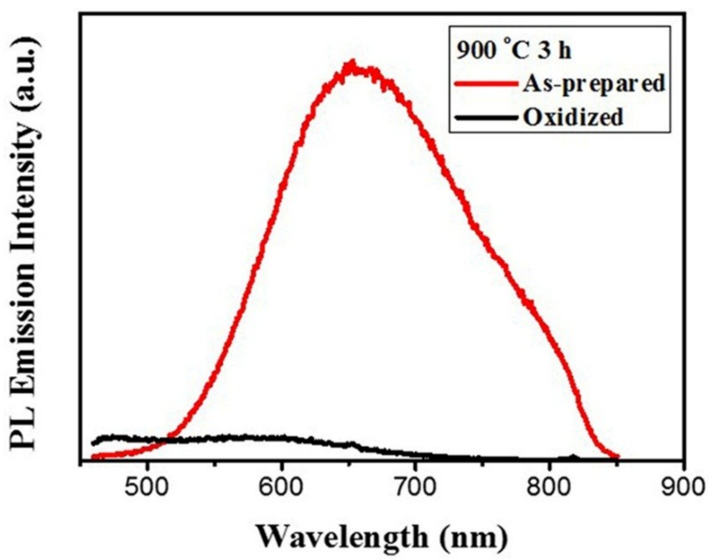

Fig.S1 Room temperature steady state PL emission spectra comparison of porous Si NWs before and after thermal oxidation under 900 ^{o}C for 3 h.

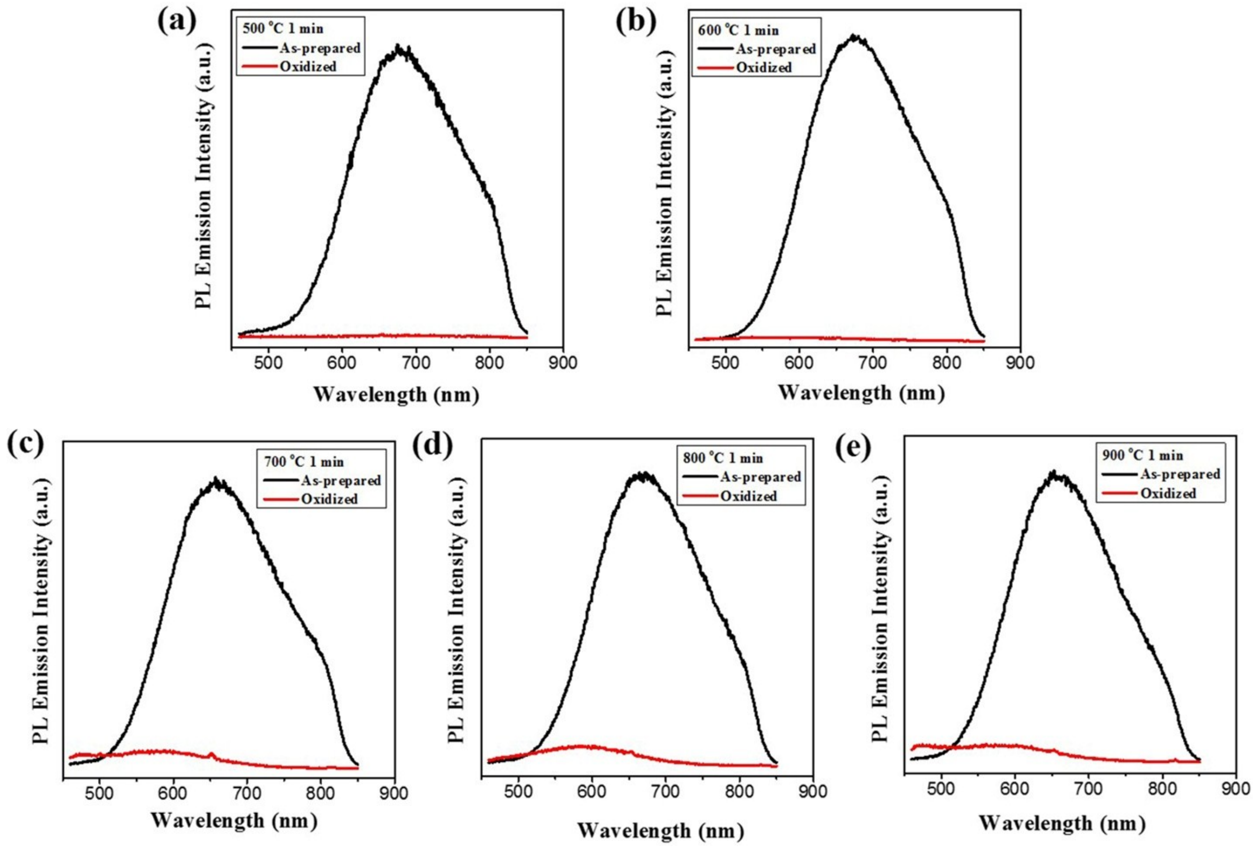

Fig.S2 Room temperature steady state PL emission spectra comparison of porous Si NWs before and after thermal oxidation under 500~900 ^{o}C for 1 min.

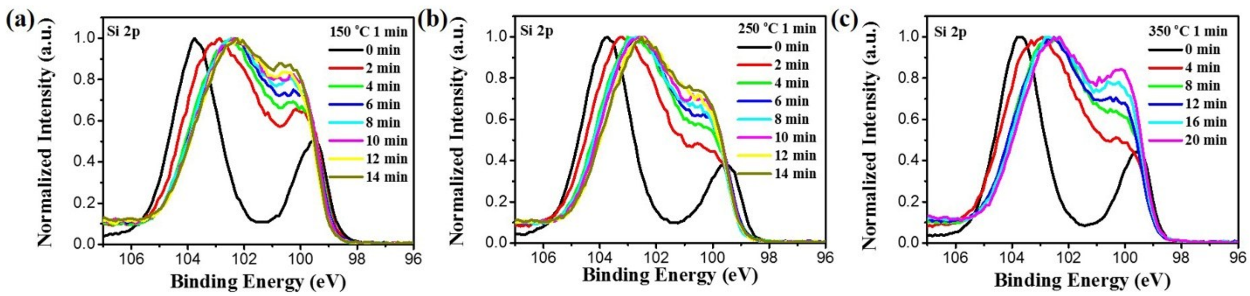

Fig.S3 XPS core level spectra of Si element with different etching time for Si NWs oxidized 1 min under various temperatures: 150 ^{o}C (a), 250 ^{o}C (b), and 350 ^{o}C (c).

The chemical environment of Si changes during thermal oxidation. Therefore, we estimated the thickness of the oxide layer by monitoring the Si 2p signal of oxidized Si NWs with different etching depth, since the Si 2p signal keeps constant when the oxide layer is entirely etched.

The XPS spectra of the oxidized Si NWs etched with different time are displayed in Fig.S3, and analyzed using the C 1s peak at 285.0 eV as the reference. For the original oxidized Si NWs, two Si 2p peaks can be observed in Fig.S3 (solid black curves), that is, elemental Si centered at 99.7 eV and oxidized Si (SiO_2) at 103.7 eV. As the etching time increases, the oxidized SiO_x peak shifts to lower binding energy due to the reduction of the oxide layer. Finally, the peak position stays at 102.4 eV and keeps constant despite the increasing etching depth. For samples oxidized at 150 ^{o}C (Fig.S3a), 250 ^{o}C (Fig.S3b), and 350 ^{o}C (Fig.S3c) for 1 min, the SiO_x peak position reaches 102.4 eV when etching between 4~6, 10~12, and 16~20 min, respectively. Since the etching rate is ~1 nm/min, the oxide layer thickness is considered to be about 5, 11, and 18 nm, respectively.

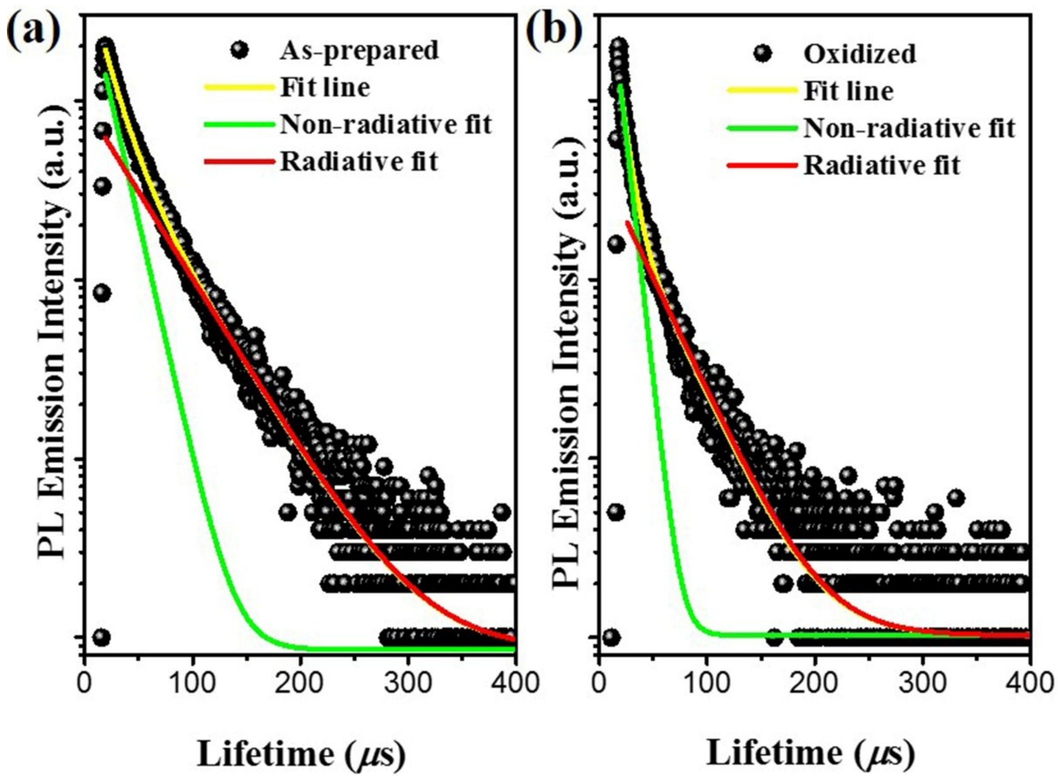

Fig.S4 PL decays with fit curves of the porous Si NWs before and after thermal oxidation under 400 ^{o}C for 1 min.

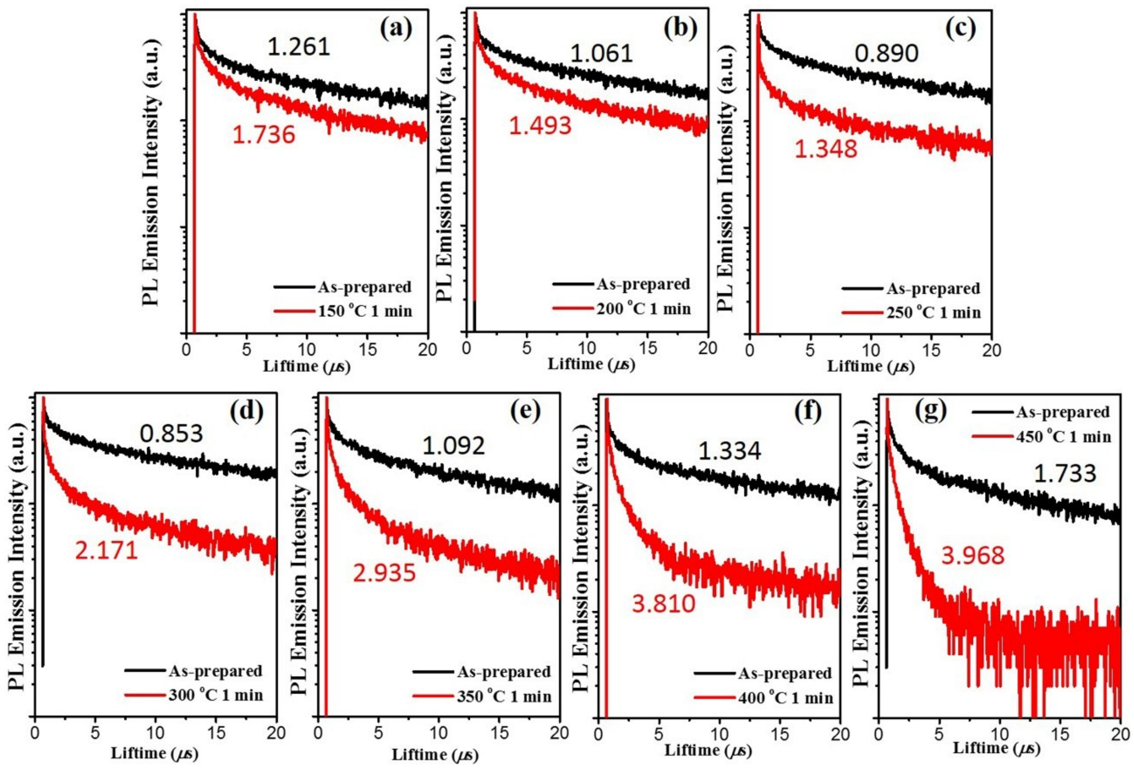

Fig.S5 PL decay traces of the porous Si NWs before and after thermal oxidation between 150~450 ^{o}C for 1 min. The labeled value stands for the corresponding weight ratio A_{nr}/A_r obtained from the best fit.

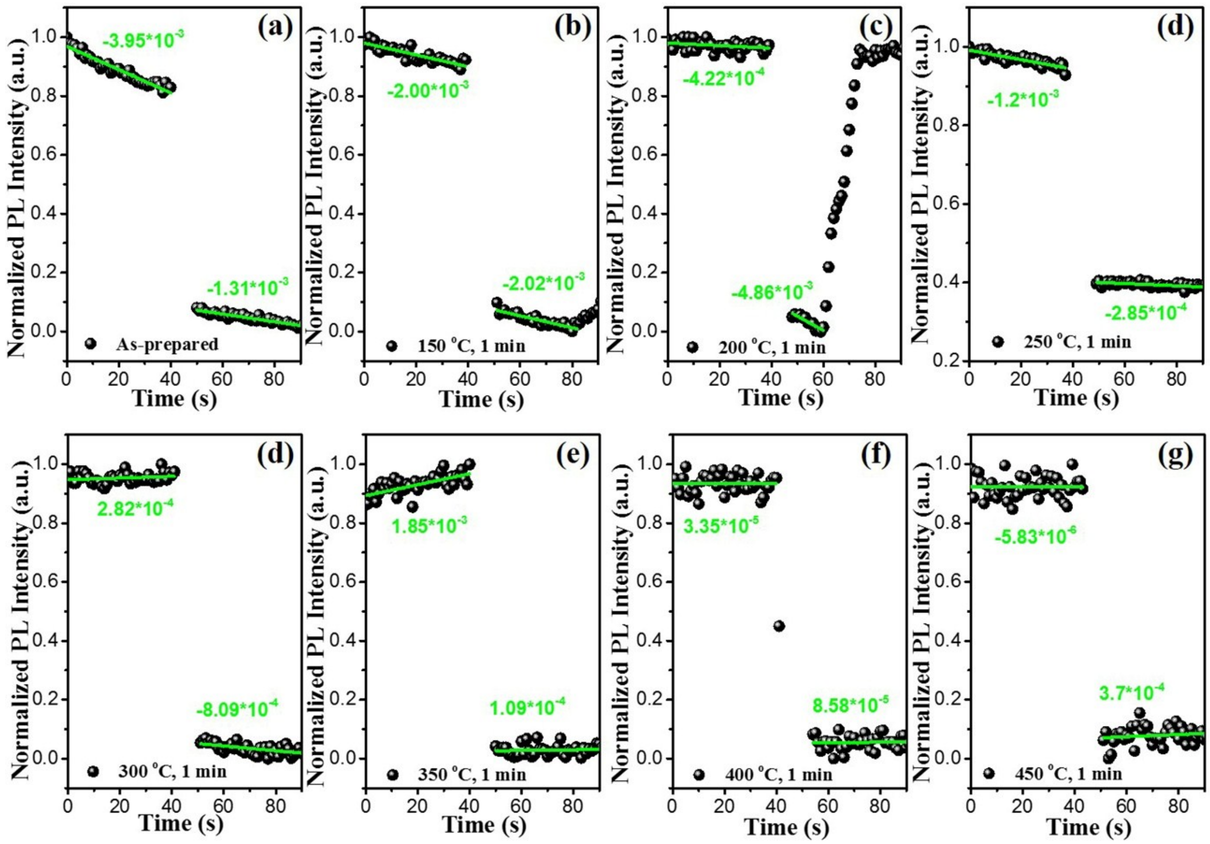

Fig.S6 PL stability analysis for porous Si NWs before (a) and after thermal oxidation under 150~450 ^{o}C for 1 min (b~g). The recovery of the PL intensity in (b) and (c) results from the volatilization of ethanol.