Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

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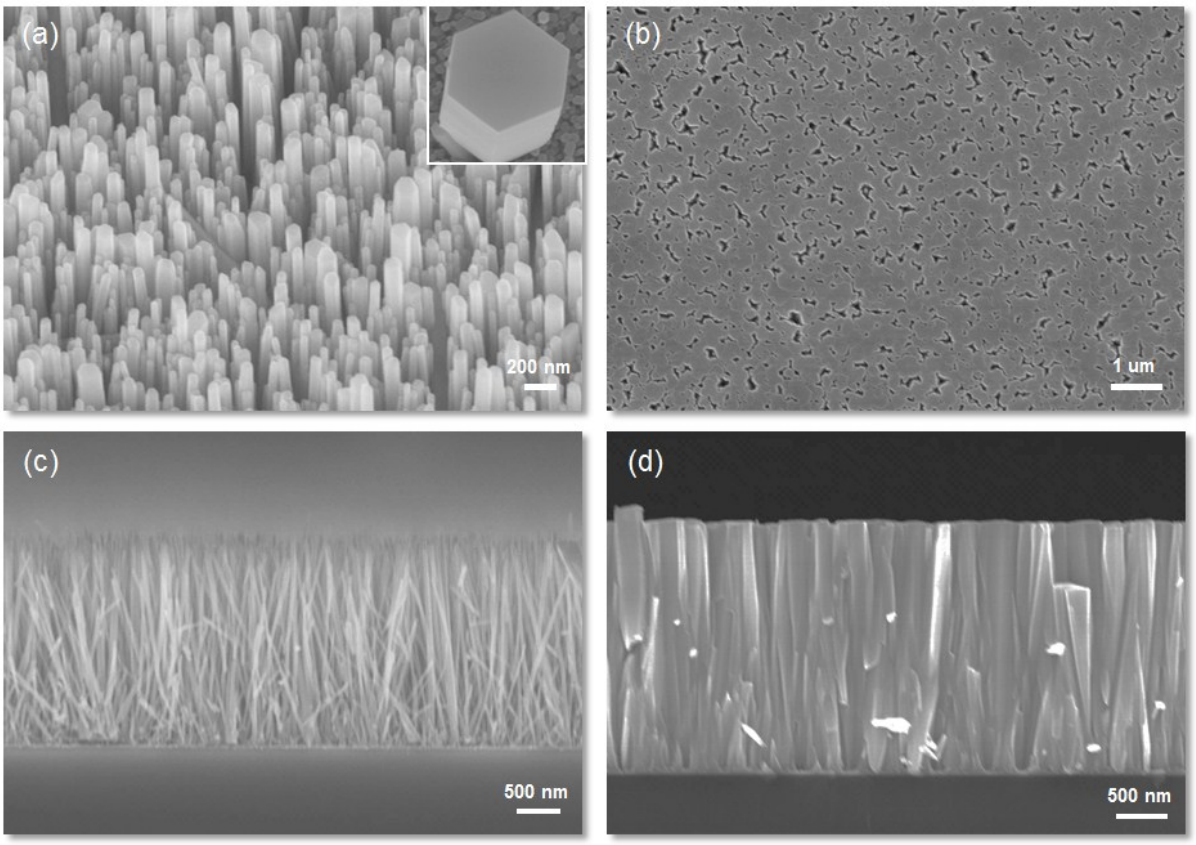


Figure S1. FE-SEM images of ZnO nanostructures prepared by a hydrothermal process. (a) Tilted and (c) cross-sectional SEM images of undoped ZnO NWs fabricated with a low molar concentration of 0.025 M. (b) Top-view and (d) cross-sectional SEM images obtained for undoped ZnO SLNRs synthesized with a relatively high molar concentration of 0.15 M. An enlarged image of a single hexagonal-shaped nanowire (diameter of ~80 nm) with a wurtzite crystal structure is shown in the inset of S1a.

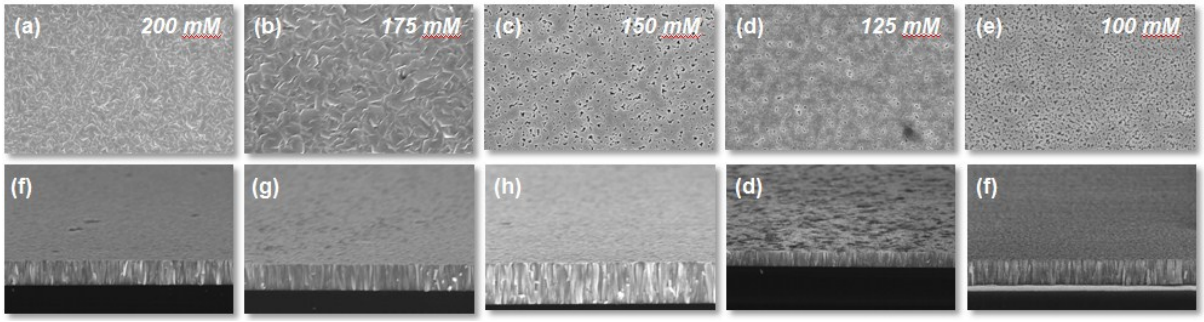
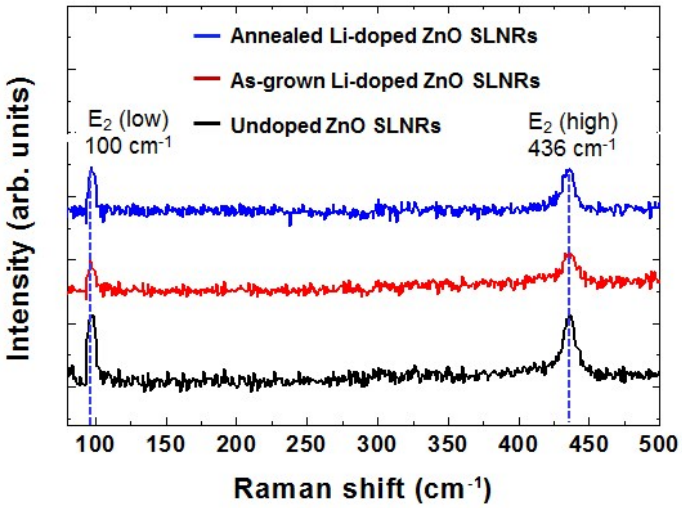


Figure S2. FE-SEM images of as-grown Li-doped ZnO SLNRs as a function of the Li concentration. (a)-(e) Top view and (f)-(k) cross-sectional SEM images of Li-doped ZnO SLNRs synthesized with Li molar concentrations in the range of 200 to 100 mM. Variations in the surface morphology of the Li-doped ZnO SLNRs are evident at the different molar concentrations.



FWHM (cm^{-1}) **Excitation source : 632.8 nm**

Sample	E_2(high)	E_2(low)
Annealed Li-doped	11.3583	4.1380
As-grown Li-doped	12.4479	5.6611
Undoped ZnO	10.3897	5.3047

Figure S3. (a) μ-Raman spectra of undoped (black), as-grown Li-doped (red), and annealed Li-doped (blue) ZnO SLNRs exhibiting dominant E_2 modes that are strongly dependent on the crystallographic orientation of the ZnO SLNRs; all samples were measured at room temperature. The table at the bottom of the figure summarizes the FWHM values of the un-doped, as-grown Li-doped, and annealed Li-doped ZnO SLNRs.

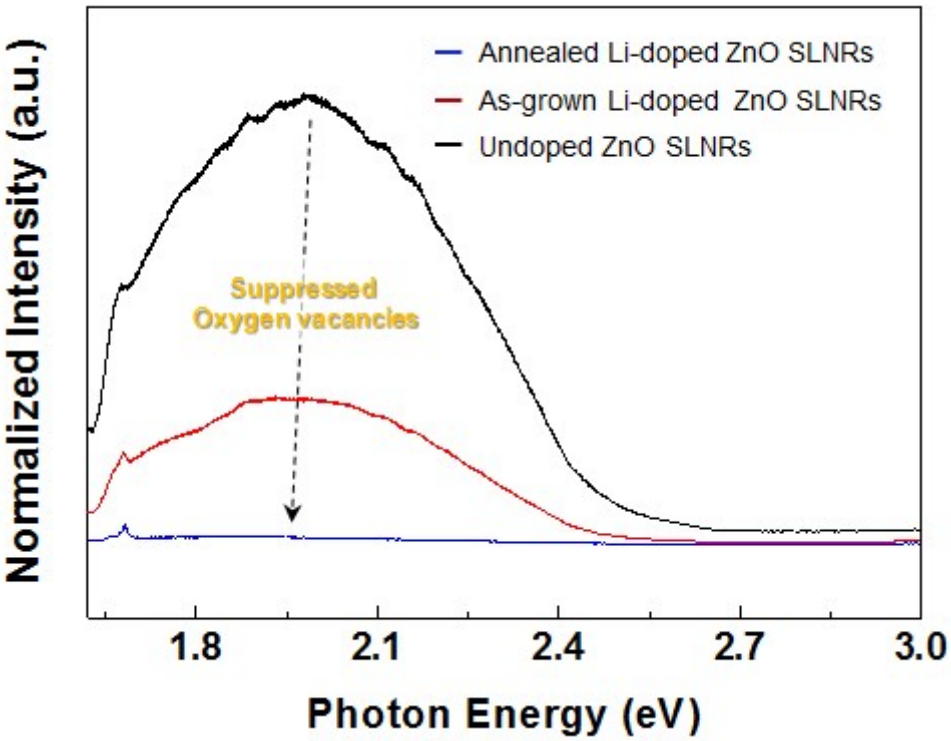


Figure S4. Low-temperature PL spectra of annealed Li-doped (blue), as-grown Li-doped (red), and undoped ZnO (black) SLNRs acquired at 10 K. Increasing the lithium content to produce n-/p-type dopants allows for a gradual suppression of deep level emissions due to a reduction in the number of oxygen vacancies (V_O).

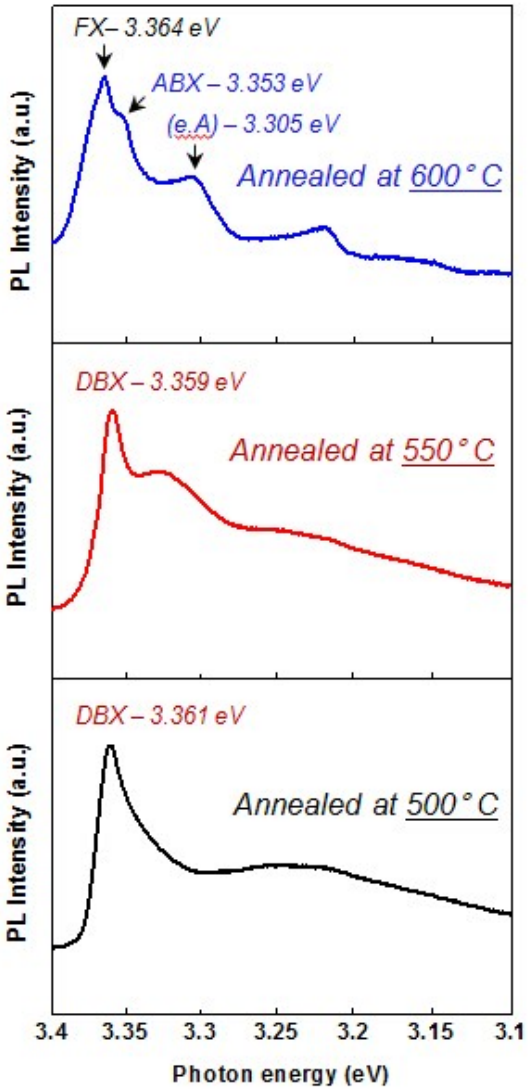


Figure S5. Low-temperature PL spectra of Li-doped ZnO SLNRs annealed at temperatures of 500 °C (black), 550 °C (red), and 600 °C (blue); all data were collected at 10 K. Acceptor-bound exciton (ABX) emission was clearly detected at 600 °C. Such emission peaks were clearly distinguishable from the peak corresponding to donor-bound exciton (DBX) emission, which is in good agreement with the time-resolved PL results. These PL findings suggest that lithium dopants can only be activated above an annealing temperature of 600 °C.

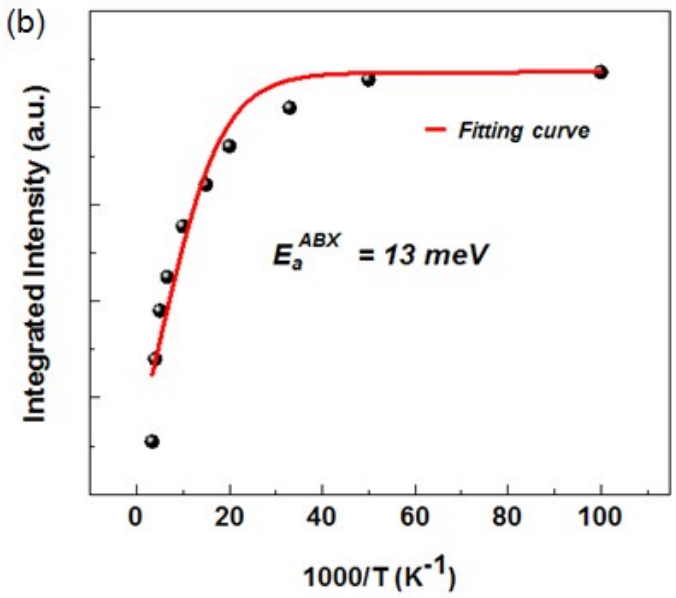


Figure S6. Arrhenius plot of the integrated PL intensities of ABX emission as a function of 1000/T for annealed Li-doped ZnO SLNRs.

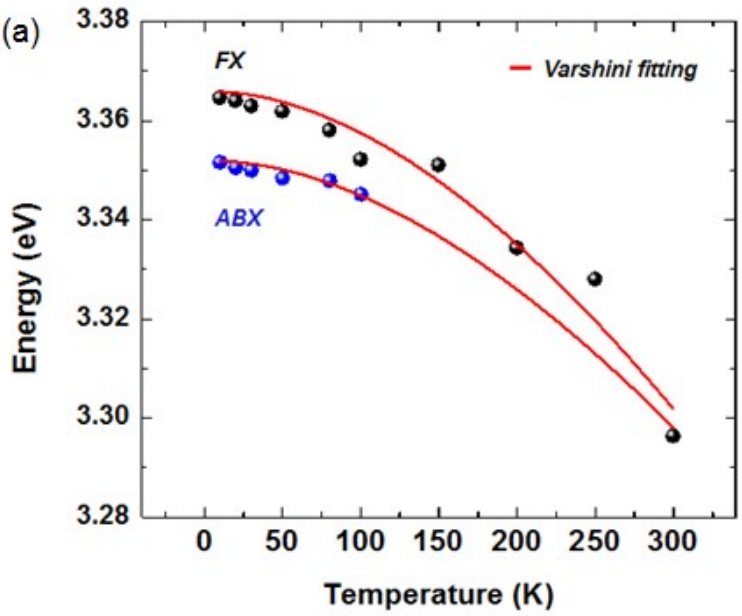


Figure S7. Temperature-dependent transition energies of FX (black circles) and ABX (blue circles) emission peaks; the data can be well fitted with the Varshini formula (solid red line).