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# Nanowire-on-nanowire: All-nanowire electronics by on-demand selective integration of hierarchical heterogeneous nanowires

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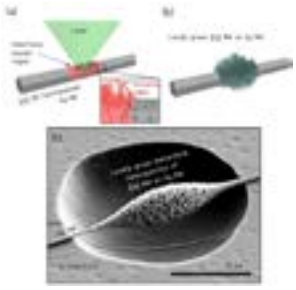
Exploration of the electronics solely comprised of bottom-up synthesized nanowires has been largely hindered due to the complex multistep integration of diverse nanowires. In this research, we report the demonstration of on-demand selective laser integration of secondary heterogeneous branched metal oxide NWs on a primary backbone metal NW in a highly selective manner based on a heater-assisted laser-induced hydrothermal growth (LIHG) process. The most widely studied NWs, silver (Ag) and zinc oxide (ZnO) NWs, are selected as the primary backbone and secondary branch NWs respectively. The highly localized and instantaneous temperature elevation by laser irradiation on the primary backbone metallic nanowire generates a nanoscale temperature field followed by a photothermal reaction to selectively grow secondary branch nanowires along the backbone nanowire. An ultraviolet photo-sensor based on the proposed selective laser grew ZnO NW branch on an Ag NW backbone is further fabricated as the simplest form of proof-of-concept for all nanowire electronics and demonstrates its potential as future electronics with compact size, low power consumption and fast response. Scanning electron microscopy and numerical simulation were employed to analyze the general morphology of hierarchical heterogeneous nanowires and scrutinize the laser polarization effect of the laser utilized in this report on an Ag nanowire with its cross-section respectively. We expect that the proposed process can be further extended to other various material combinations whose hydrothermal growth routes are known. With a broader range of applicable nanowires, the proposed process shows great promise in the bottom-up fabrication of all-nanowire nanoelectronics, such as multifunctional environmental sensors.



## Biography

Jinwoo Lee is currently a PhD candidate at Seoul National University in South Korea after he completed his master degree at KAIST. His research of interest is laser-induced material growth, laser sintering of materials for functionalization and fabrication of energy storage/harvesting device.

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