Low cost and highly reliable fabrication route of chemical and biological nanowire sensor

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Semiconductor nanowire field effect transistors (NWFETs) have attracted strong research interest as a platform for specific identification of biomolecules in life sciences. The conventional fabrication methods of NWFETs with the well-established bottom-up approach have been demonstrated as a promising platform of various applications in life science so far, but still suffer from their inherent drawback of mass production. To address these issues, we developed a novel top-down approach ZnO NWFETs in this work. This work is composed of sequential processes of ZnO thin film deposition, nano-imprinting lithography and low-damage dry etching, leading to a reasonable alternative for the low cost mass productions. Furthermore, the optimized ZnO NWFETs with effective surface functionalization polymer-like amorphous carbon (PAC) are demonstrated to achieve high performance of the conventional bottom-up based devices in terms of the real-time detections of pH sensing and biological sensing application. Finally, various aspects in terms of chemical and biological sensing behaviors were compared to the conventional bottom-up based NWFETs with high performance.