Top-down Fabrication Challenges in Zinc Oxide Nanowire Field Effect Transistors

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Zinc oxide (ZnO) is now widely accepted as the material of choice for flat panel display, photovoltaics, environmental and bio-chemical sensors technology. Depending on the applications, the ZnO materials’ properties can be modified by fabrication steps during deposition\(^1\), bottom-up or top-down fabrication method, plasma and wet process treatment. To ensure good electrical performance uniformity of devices across the wafer, different fabrication control techniques have been proposed. We introduce the low temperature deposition of ZnO and various novel top-down methods developed at Southampton that is suitable for the fabrication of nanowires (see Figure 1) and thin film field effect transistors. We will discuss the fabrication issues associated with the top-down method and how line edge roughness reduction in the nanowire FETs can shift the device’s enhancement to depletion mode operation and improve the subthreshold slope and field effect mobility\(^2,3\). These processing steps are seen as the enabling method for the fabrication of future integrated circuit in the next generation flat panel display and bio-chemical sensing technology.

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