Metal Oxide Nanowire Meets Internet of Things (IoT)

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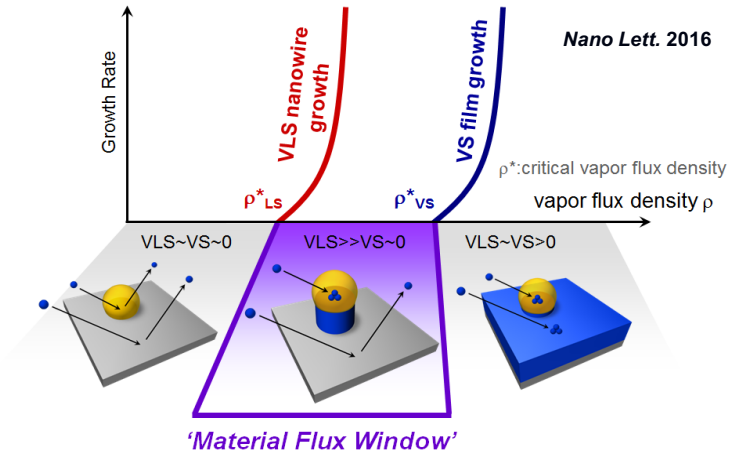
Abstract

Single crystalline metal oxide nanowires are interesting nanostructures due to their abundant resources and robustness in air and water. In addition, metal oxides exhibit many fascinating physical properties, including high-Tc superconductors, ferromagnetism, ferroelectrics, memristive properties, photocatalytic properties, transparent conductors and others, which are not attainable to conventional semiconducting materials (group IV and III-V). However, fabricating single crystalline metal oxide nanowires has been based on a rule of thumb, there has been no general principle to design metal oxide nanowires. The feasibility of functional oxide nanowires, whose physical properties are hardly attainable to other materials, has been also strongly limited. Here I demonstrate i) a fundamental design concept for creating single crystalline oxide nanowires via vapor-liquid-solid (VLS) pathway, and ii) a development to measure the physical properties of a single nanowire, including electrical and thermal transport properties. By comparing experimental VLS nanowire growth to MD simulations. we found that the difference between LS interface and VS interface on the critical nucleation size essentially allows us to perform VLS nanowire growth. This knowledge can be expanded to discover novel metal oxide nanowires via VLS mechanisms. In addition, we have shown the impact of crystal growth interface on the electrical properties of metal oxide nanowires. I believe that the presented approaches by utilizing meal oxide nanowires offers an important platform for investigating not only nanoscale physical properties of transition metal oxides but also exploring novel IoT nanodevices with other materials, which had not been possible to be integrated onto Si and/or plastic substrate.



Keywords: Oxide Nanowires, Nanoscale Physical Properties, IoT Nanodevices

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