CHAPTER 5

Conclusions and Suggestion

5.1 Conclusions

We have controlled the growth kinetics by using a microwave-assisted thermal oxidation for synthesizing ZnO nanostructures. With this simple and fast process, we have realized a unique nanostructured ZnO morphology having tetrapod-like features with leg-to-leg connecting, so-called "inter-linked tetrapod network of ZnO" or ITN-ZnO. Moreover, these ITN-ZnO exhibits unexpectedly properties of electrical and gas sensing properties when compared to other morphologies of ZnO. We also use model mechanism to explain the ethanol sensing mechanism under UV light at room temperature because the resistivity of ITN-ZnO increase under ethanol vapor gas that different from previous reports. The lesser potential barriers significantly support transference of the ultraviolet-generated charge carriers that were required to reach electrodes of gold (Au), bring to less resistance of sensor. Based on the succeeded results, the charge transport mechanisms have also been suggested. These sensor characteristics propose that the ITN-ZnO was applied for ultraviolet sensors and another optoelectronic device.

5.2 Suggestion

Therefore, the inter-linked tetrapod ZnO network is one of an interesting morphology that can lead to many new applications due to its novel properties. Since the unique ITN-ZnO can be obtained by the simple and fast process by microwave-assisted thermal oxidation. Up-scale mass production of this ITN-ZnO would be easily performed and also increases feasibility for device fabrication at low cost. The novel properties of ITN-ZnO are beneficial for electronic, photonic, opto-electronic, and sensing applications. ITN-ZnO may provide the means to improve the devices based on ITN-ZnO. Here, UV sensor and RT gas sensor with improved performance are demonstrated. For UV sensor, this could be applied in space-based applications due to superior properties of radiation damage resistance in ZnO. For gas sensor, this can raise feasibility for RT gas sensor application which is one of a major limitation in using gas sensors based on the metal-oxide semiconductors. In addition, this RT gas sensor could be applied for sensing various gases including hydrogen which would require the low operating temperature for safety reason.