Chapter 6

Conclusions and prospects

The exploration into nanotechnology and more specifically for our work on ZnO nanorods has only begun. Throughout this work, we have speculated on possible directions based on what has been established in our work. For example, the bottom-up growth technique, allows one to fabricate nanorods in a variety of different materials. With the low temperature growth technique developed, making it compatible with existing semiconductor processes, one can now pursue the explo[illegible]terojunctions, stand alone or integrated with an ex[illegible] However, the challenge lies with the direction o[illegible] nanorod due to the thermal process. With or wi[illegible] nanorods can grow in any direction because the [illegible]gy. Hense, external magnetic or electric effect to help the formation of well-align and site-controlled ZnO nanorods is a possible approach.

ZnO nanorod has enough emission current for displays. With particularly doping, for example Ga, ZnO nanorods can have a sharp shape and this could be a candidate comparing to CNTs for FED emittes. Moreover, intrgration with Si-base device is expected by arranging the growth density and position with the site-controlled process.

In additional, Blue and self-emission from ZnO nanorods was observed in our work. It's a reasonable guess that defect dominate the emission process and it need to be clear in the future. Evenmore, blue luminescence in large area or Vertical-Cavity Surface-Emitting Laser (VCSEL) by ZnO nanosize emitter is a very interesting subject.

Besides the p-n heterojunction between ZnO and Si, the homojunction of ZnO is a good idea for FED. One study conducted by Park et al. showed growth of ZnO/ZnMgO heterostructures on ZnO nanorods using metal-organic vapor phase epitaxy [194]. An even greater flexibility in device design would ensue if the doping levels in the nanorods can be controlled. However, the challenge lies with the p-doping. Measured p-type ZnO thin films have been reported, however, they are reported to be unreliable. Depending on the oxygen pressure used during growth [195] or the mixtures of O2/N2 gases during deposition [196], n-type or p-type films can result. Recently, the use of arsenic (As) holds promise as an acceptor for ZnO as Ryu et al. demonstrated a p-n junction in ZnO [197]. In any case, better contact or less [illegible] from lattice mismatch and similar concentration [illegible] reduce RC constant could enhance the frequency [illegible].

The researc[illegible]ology has become an interdisciplinary fie[illegible] from engineering, physical sciences, and biology. It is perhaps this involvement from all disciplines that has conjured up the vision of nanotechnology having a tremendous impact in all sectors of technology including advanced medicine. The present state of nanotechnology is still in its infancy, resembling the early stages of the information age with the advent of the computer. Today, the computer is considered merely information sharing tool. Similarly, the work being done here is setting the foundation for future explorations where nanotechnology will not be the novelty, but rather the tool used in creating novel technologies.

For a field dealing with material that is very, very small, the future certainly looks very, very big.