6. Conclusion

Figure 6.1 collects all data for the I_D/I_G dependence on Turn-on field. Although the data may look rather scattered, there is a general trend that the turn-on field decreases with increasing ratio, regardless how we modified I_D/I_G. The four points at up-sight corner were obtained when treated with oxygen-added processes which may have annealing effects.

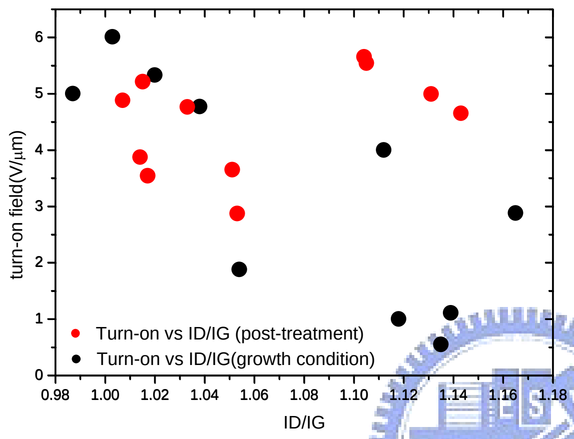
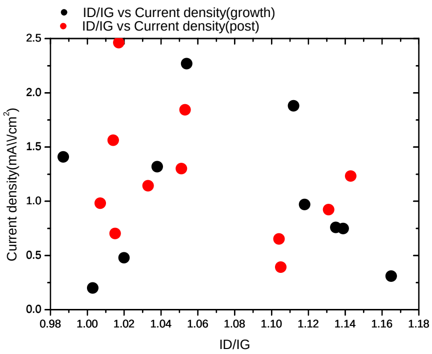
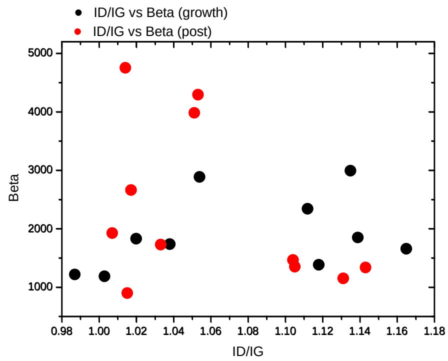


Figure6.1: ID/IG dependence on Turn-on field. The black dots: obtained in growth process, the red dots: obtained in post-treatment process.

Figure 6.2 shows the I_D/I_G dependence on Current density and Beta. We could see in figure 6.2(a) that current density may have a maximum values when the I_D/I_G ratio was between 1.06 ~1.10. That means more defects indeed increase the electron emission sites and result in higher current density, but too many defects could possibly diminish the field emission property of the CNT. The same trend was also obtained in figure 6.2(b). Beta seems to have maximum values when the I_D/I_G ratios were between 1.06~1.10.



(a)



(b)

Figure6.2: (a) ID/IG dependence on current density, (b) ID/IG dependence on Beta. The black dots: obtained in growth process, the red dots: obtained in post-treatment process.

Summary

We summarized all the results reported in this study as follows:

1. The ratio of I_D/I_G does not have a strong relation with field emission performance by modifying various growth parameters, including bias voltage, N_2 and O_2 assistant gases.

2. By contrast, modifying I_D/I_G with low power laser post-treatment shows that there is a strong relationship between the ratio and field emission performance.

3. More defects created could reduce the Turn-on field in both growth and post-treatment process.

4. Appropriate amount of defects could raise the current density and Beta, but a plethora of defects result in opposite effect.

5. We suggest that morphology (distribution and spacing) and graphite structure (crystallite quality) may both have influences on field emission properties.

6. The SEM and TEM images provide evidence in support of our general qualitative arguments.