

Nanoporous AAO membrane has been successfully fabricated by two-step anodization. After barrier layer removal, Co catalyst could be favorably deposited at the pore bottom by electroplate. Using hydrogen and methane as precursor gases, highly ordered CNT arrays synthesized by microwave ECR-CVD own good crystallinity and uniform tube length. Because of lower growth rate of ECR-CVD, it is easy to tune the length of tubes. From cross-sectional TEM, Co catalyst are encapsulated at the tip of tube implying the tip growth mechanism. The field emission properties of CNT arrays with different length show that longer CNTs possess lower turn-on voltage and higher threshold voltage. Besides, a simple method to control tube number density was introduced. By changing the precursors flow ratio, it caused the competition reaction between amorphous carbon deposition and CNTs growth indirectly. It was found that the number of CNTs escaped from the AAO nanopores decreases linearly following the increase of the CH_4 concentration. This is because the amorphous carbon covers the AAO nanopores blocking CNTs outgrowth. Whereas amorphous carbon conceals the tip of CNTs hastening the poison of Co catalyst, the length of CNT arrays tends to decrease as increasing CH_4 concentration, simultaneously. Surface analyses were conducted using AES and

Raman spectrum to prove above purposes. Optimal field emissions were obtained by specific CNT array of appropriate density and length.

