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# **Growth characteristics of carbon nanotubes via anodic aluminum oxide template on Si substrate using dc PECVD without catalyst.**

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Use of the anodic aluminum oxide (AAO) template for the synthesis of carbon nanotubes (CNTs) has the advantages in the control of alignment, diameter and length of them. The high level of ordering and uniformity of CNTs on AAO/Si substrate is more useful for applications such as data storage, field emission displays and sensors. CNTs on AAO/Si also offer the prospects of deriving computational functions from the collective behavior of symmetrically coupled nanotubes. We have fabricated CNTs with acetylene ( $C_2H_2$ ) using well-ordered AAO templates on Si substrate. Without deposition of catalytic metal into the bottom of the AAO template, CNTs were grown by direct current plasma-enhanced chemical vapor deposition (DC-PECVD) within a nano-channel alumina template at 550 °C. The diameter of the CNTs strongly depends on the size of the pores in the AAO template. The effect of process parameter such as plasma intensity, temperature and gas composition morphology of CNTs was investigated. The density control of CNTs was possible through the control of pore size depending on the anodizing conditions such as anodizing temperature and time. For the analysis of the morphology, the microstructure and crystallization of CNTs, scanning electron microscope (SEM), transmission electron microscope (TEM) and Raman spectroscopy were employed, respectively.