# Controllable Carbon Based Nanostructured Materials Applied in Nanoelectronics

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**Abstract**

The sustaining of Moore's law required transistor scaling continuously. Therefore, the adoption of emerging materials has been tremendous purpose for future nanoelectronics applications. Several emerging devices such as Si nanowire, carbon nanotubes, III-V compounds field effect transistors (FETs) all hold promising to be potential candidates to extend Moore's law. A systematic work such as random oriented SiCN tubes, nanowire / conical rod and 2D graphite/seaweed structures are covered and their corresponding properties have been reached in this study. The growth mechanisms and electronic properties of nanostructured materials have been addressed. The development of nanostructured materials is crucial in enhancing emerging devices application.

The integration of CNTs into Si-based metal-oxide semiconductor field effect transistor (MOSFETs) or new nanoelectronics remains a challenge in the fields of transistors and interconnects. CNTs are accepted as candidates for use in molecular electronics to overcome the physical limitation of current Si transistors and Cu interconnections [1-2]. Bundles of CNTs are naturally deposited in vertically dimension, since they tend to adhere to each other vertically. The feasibility of realizing this vision depends on direct approaches to selective deposition in the trench or holes of Si wafers. Bundles of CNTs in the trenches and holes can provide sufficient current density in the form of channels and conductors, respectively. This study, systematically elucidates the synthesis of CNTs by microwave plasma CVD (MPCVD). Our investigation, Fe catalyst, $CoSi_2$ and $NiSi_2$ film employed frequently as gate electrode and a contact material in Si nanoelectronics are applied (Fig1). The selective growth of CNTs in trench/hole/planar approaches is also examined (Figs. 2 and 3). The morphology and nanostructured of CNTs are characterized. The field emission characteristics and ballistic conduction behaviors of CNTs deposited in the trenches and holes are investigated to determine electronics performance.

**References**

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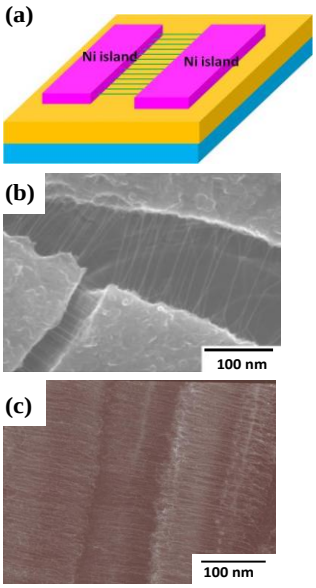


**Fig. 1(a)** Schematic diagram of horizontal CNTs growth on parallel Ni islands. (b), (c) Corresponding SEM images of horizontal CNTs growth in between two islands.

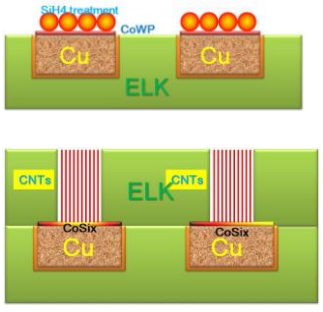


Fig. 2 Schematic diagram of Cu Damascene and CNTs integration

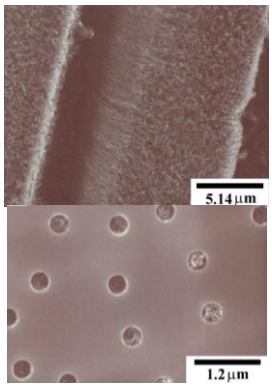


Fig. 3 CNTs selective deposited on patterned Si substrate