

# Alcohol CVD Growth of Horizontally Aligned Single-Walled Carbon Nanotubes on R-cut Crystal Quartz Substrates

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Single-walled carbon nanotubes (SWCNTs) possess many excellent properties and are considered as a promising material in the field of nanotechnology. Their orientation control is important for various device applications of SWCNTs. It is known that horizontally aligned SWCNTs can be grown on crystal quartz substrates [1] due to the interactions between SWCNTs and the surface atomic structure of quartz. Toward high-performance devices using horizontally aligned SWCNTs, understanding of the alignment mechanism and enhancement of SWCNT density are desired. In this study, we performed alcohol chemical vapor deposition (CVD) growth [2] of SWCNTs on R-cut crystal quartz substrates which is cut parallel to the natural R-face. It was found that SWCNTs were grown horizontally along the direction of the x-axis on R-cut crystal quartz substrate and the density of SWCNTs was increased by lowering carbon feeding rate. High-density growth was achieved by patterned catalysts and optimized CVD condition (Fig. 1).

[1] C. Kocabas et al., *J. Phys. Chem. C* **111**, 17879-17886, (2007).

[2] S. Maruyama et al., *Chem. Phys. Lett.* **360**, 229-234, (2002).

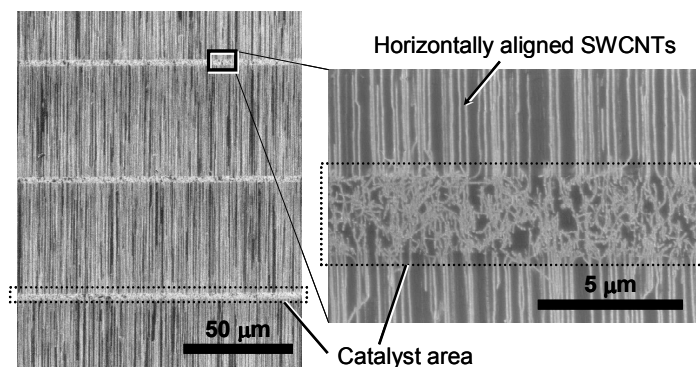


Fig. 1 SEM images of horizontally aligned SWCNTs.

## Biography of Mr. Inoue

He received the B.E. and M.E. degrees in mechanical engineering from the University of Tokyo in 2009 and 2011, respectively. He is currently working toward the Ph.D. degree in mechanical engineering at the University of Tokyo.