

# Tuning the SWNT atomic structure during the floating catalyst chemical vapor deposition (FC-CVD) synthesis

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**Date: Thursday, November 10, 2022 14:00-15:30**

**Venue: Faculty of Engineering Bldg. 2, Room 31A**

**Online (hybrid)**

### Abstract:

Floating-catalyst CVD (FC-CVD) is a highly promising technique for the scalable synthesis of single-walled carbon nanotubes (SWNTs). We have been studying FC-CVD systems with several carbon precursor molecules, including CO, C<sub>2</sub>H<sub>4</sub>, CH<sub>4</sub>, ethanol, methanol, isopropanol, and toluene, using mainly iron catalyst nanoparticles, either generated in-situ via ferrocene vapor thermal decomposition or pre-made via the spark discharge aerosol generator. We have determined the SWNT atomic structure i.e. (n,m) distributions directly via the electron diffraction of individual tubes supported by the optical absorption spectroscopy studies. Using ferrocene as the catalyst precursor, CO as the carbon source and CO<sub>2</sub> as the growth promoter, we show that the SWNT atomic structure i.e. (n,m) distribution and the related thin film color can be directly tuned by adjusting the CO<sub>2</sub> concentration. Also, the fraction of metallic tubes can be tuned via adding carbon dioxide. When using CO as the carbon source, the chiral angle distributions are biased towards the armchair side, while with hydrocarbons as the carbon sources, the chiral angle distributions are flat.

We will present results on the synthesis of over 90 % semiconducting tubes with 1.2 nm diameter from ethanol via adding methanol with ferrocene as catalyst precursor and thiophene as the growth promoter (Fig. 1). Finally, we will introduce preliminary results on producing 1 nm diameter SWNTs with around 90 % semiconducting tube fraction using isopropanol as the carbon source when using nitrogen carrier gas with minor fraction of hydrogen as the carrier gas as well as the thiophene as the growth promoter.



**Registration (Venue/Online)**  
<https://forms.gle/Xuh1Wt3skHnwiBC56>  
**Please register by Nov 7th.**

主催： 東京大学大学院工学系研究科専攻間横断型教育プログラム 機械システム・イノベーション (GMSI)

最先端融合科学イノベーション教育研究コンソーシアム (CIAiS)

未来社会協創国際卓越大学院 (WINGS CFS)

量子科学技術国際卓越大学院 (WINGS-QSTEP)

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高齢社会総合研究国際卓越大学院 (WINGS-GLAFS)

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