

Master thesis

Filling apoferritin with metal ions for defined SWNT catalyst formation

Motivation

Single Walled Carbon Nanotubes (SWNTs) are exceptional nanostructures with many outstanding properties and with possible revolutionary applications on the horizon. Utilization of individual SWNTs in nanodevices often requires production of SWNTs with tailored properties. Catalysts with defined size and composition are required to fulfill these requirements.

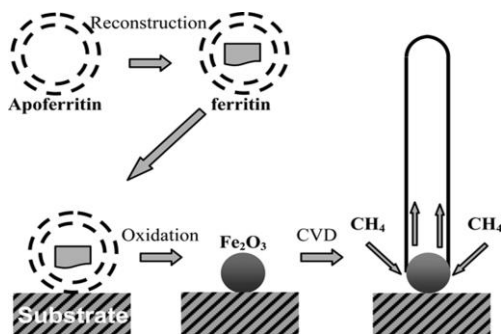


Illustration of the catalytic growth of SWNTs using apoferritin (image: Y. Li, et al.: J. Phys. Chem B, **105**, (2001) 11424).

Goal

This project will focus on development of well-defined catalysts for synthesis of SWNTs with tailored characteristics. A hollow protein, apoferritin, can be loaded by different metal ions and their mixtures to prepare catalyst particles with the desired size distribution and composition. These catalysts will be used for SWNT growth by chemical vapor deposition.

Learning Opportunities

- Become familiar with catalyst preparation for SWNT growth.
- Hands-on experimental work. Use state-of-the-art characterization methods and equipment (AFM, SEM, Raman, ...), data processing.

Work Description

1) Apoferritin can be controllably loaded by different metal ions and their mixtures to form the

catalyst precursor, ferritin. Concentration of ferritin in solution and its deposition rate and yield onto chip surfaces will be measured and controlled.

2) Ferritin adsorbed on the substrate will be transformed to catalyst particles for SWNT growth. The size distribution and composition of these particles will be determined and controlled.

3) The activity of catalysts for nanotube synthesis will be evaluated with respect to carbon source gas and its mixture with hydrogen and on the growth temperature.

4) A scientific report will be written and defended.



Illustration of a SWNT growing from a metal catalyst (image: S. Hofmann et al.: Nano Letters, **7** (2007) 602).

Your profile

You are a student of micro process engineering, mechanical engineering, material science or bio/chemistry with an interest in catalyst formation, carbon nanotubes and nanotechnology. You should be able to work independently in an organized manner. Patience, persistence, responsibility, ability to work independently, creativity and enjoying working in laboratory and with technical equipment are desired personal qualities.

Contact

Dr. Miro Haluska, Seoho Jung, Morten Vollmann
 Micro- und Nanosystems
 E-mail: haluska@micro.mavt.ethz.ch
 E-mail: mvollmann@ethz.ch
 E-mail: seoho.jung@micro.mavt.ethz.ch