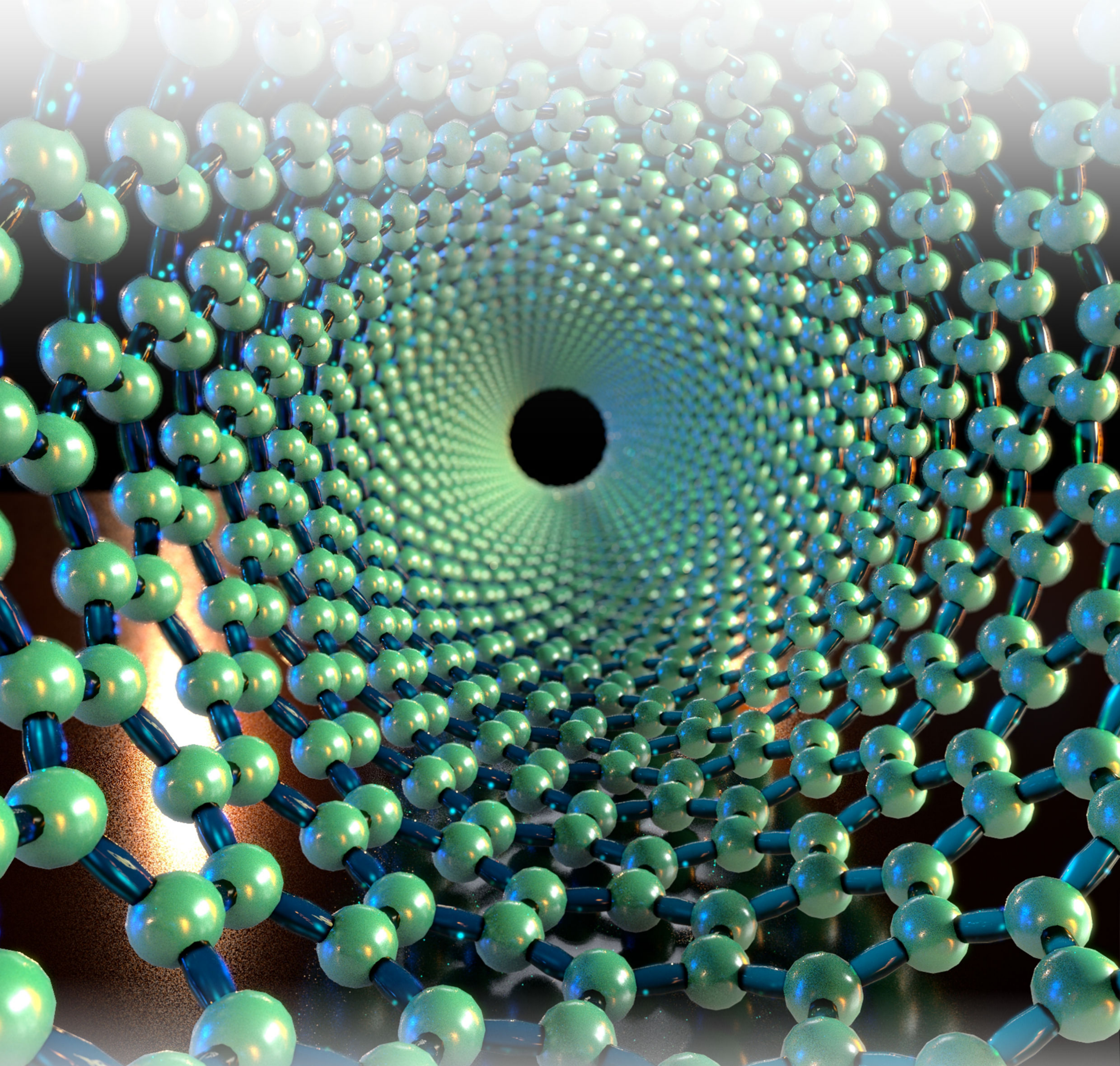
2018 PKU-UTokyo Nanocarbon Summer Camp

August 5-10, 2018 Peking University, Beijing



北京大學 PEKING UNIVERSITY

東京大学 THE UNIVERSITY OF TOKYO

2018 PKU-UTokyo Nanocarbon Summer Camp

General information

This year's Summer Camp will bring together 29 participants, including 13 (3 faculty members and 10 graduate students) from UTokyo, and 16 (6 faculty members + 10 students) from PKU. For a week time, participants will intensively discuss recent progress in Nano-carbon research, and propose potential collaborations between PKU and UTokyo.

In the morning of 5^{th}, we will invite two professors, Anyuan Cao and Yanfeng Zhang, to give us two tutorial talks about carbon nanotube and graphene. All participants are suggested to attend.

From afternoon of 5^{th}, student participants will be divided into 5 teams for independent work and discussion. Each team will propose a potential collaborative research direction between PKU and UTokyo. To help everybody know each other, a self-introduction session will be held in the afternoon of 5^{th}, and all students will be asked to give a 5 min presentation including brief introduction of themselves and their research.

After intensive work and discussion, students give their final report and presentation on 10^{st}.

The official language of summer camp is English. The dress code for the Camp is casual; you do not need any formal clothing.

Summers in Beijing are fairly hot, expecting temperature is 25-35°C, and it may rain. Enjoy the summer camp in Beijing!

<table>
<tr><th></th><th>August 4
Sat.</th><th>August 5
Sun.</th><th>August 6
Mon.</th><th>August 7
Tues.</th><th>August 8
Wed.</th><th>August 9
Thur.</th><th>August 10
Fri.</th><th>August 11
Sat.</th></tr>
<tr><td>8:30-12:00</td><td></td><td>Opening ceremony
&
Tutorial lectures</td><td>Team work
(A713
&A813)</td><td>Team work
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&A813)</td><td>Campus tour</td><td>Team work
(A713
&A813)</td><td>Free Time</td></tr>
<tr><td>12:00-13:30</td><td rowspan="3">UTokyo delegate arrival</td><td colspan="6">Lunch and discussion</td><td rowspan="5">UTokyo delegate departure</td></tr>
<tr><td>13:30-15:00</td><td rowspan="3">Student presentation
&
group working
(A813)</td><td rowspan="3">Lab tour</td><td rowspan="3">Team work
(A713
&A813)</td><td rowspan="3">Team work
(A713
&A813)</td><td rowspan="4">City tour</td><td>Project competition
(A717)</td></tr>
<tr><td>13:50-17:30</td><td>Project review
&
Awards</td></tr>
<tr><td>17:30-18:00</td><td>Reception
(Heyuan)</td><td rowspan="2">Banquet</td></tr>
<tr><td>18:00-21:00</td><td></td><td></td><td></td><td></td><td></td></tr>
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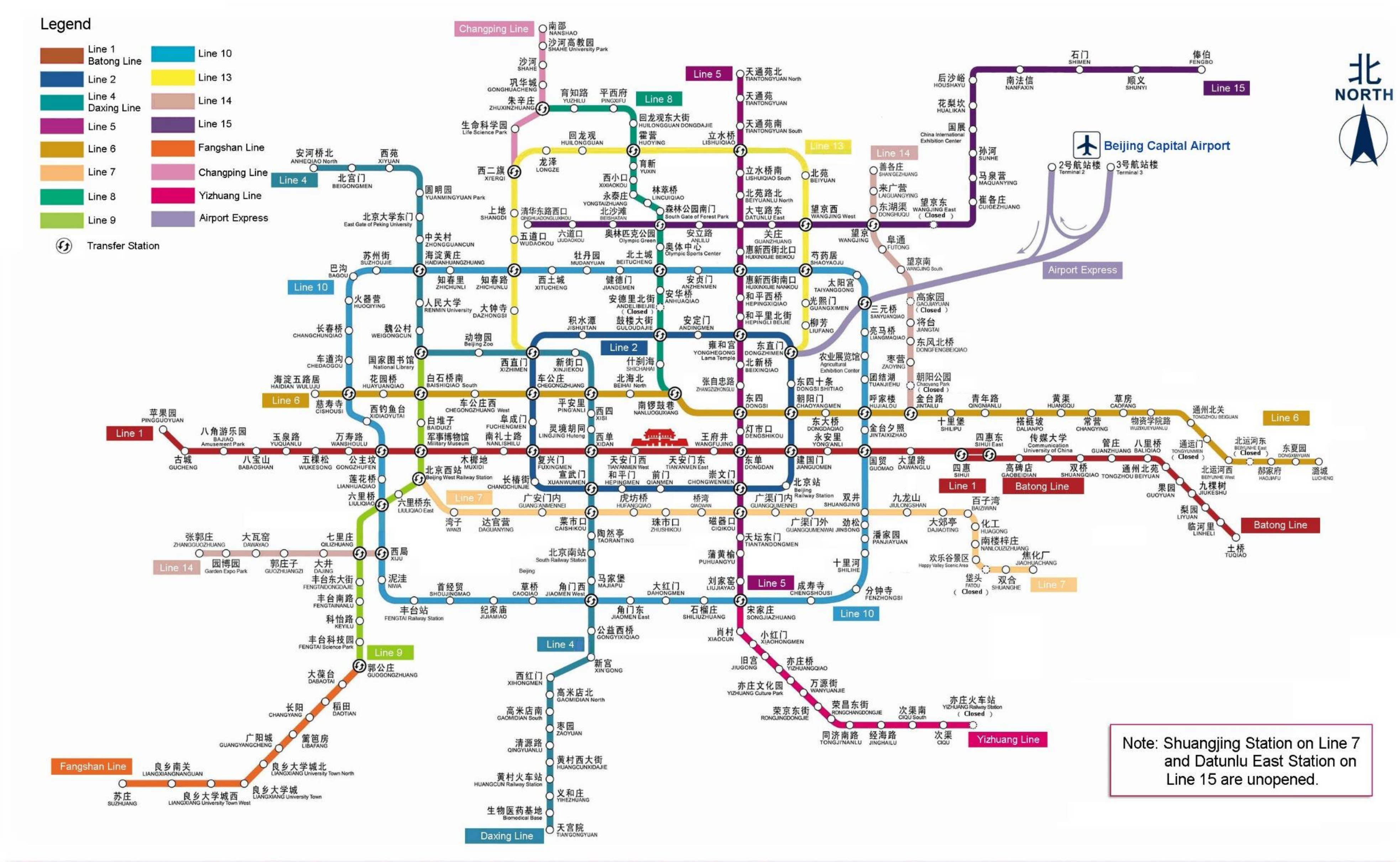
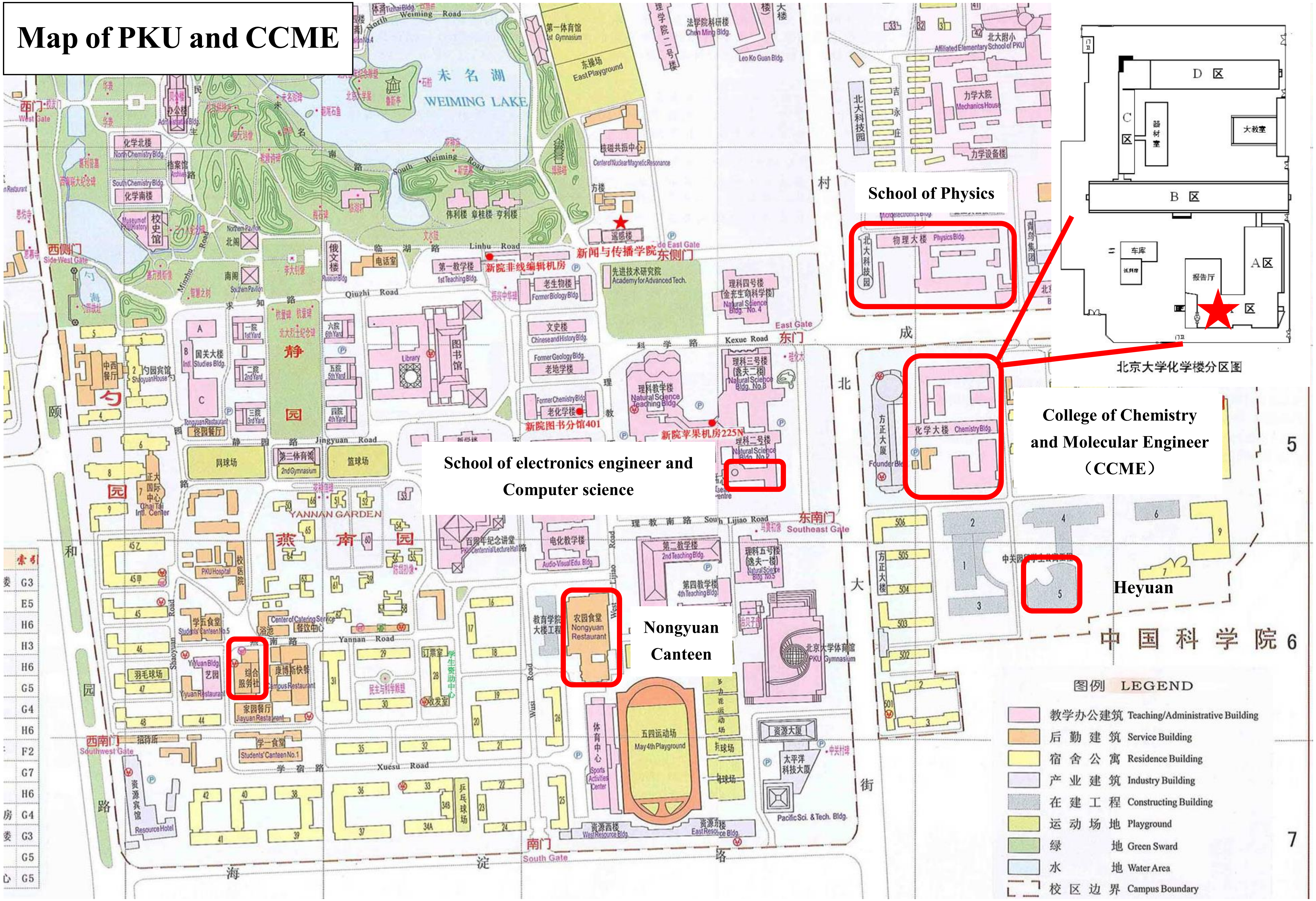
Beijing Subway Map (Cilck to Enlarge)



Map of PKU and CCME



Map from CCME to Hotel

Time: August 4th--------August 11th

Address: 博思园客座公寓

Bo Si Yuan Guest House

680 meters away from CCME, about 10 minutes

1. *Tutorial lecture*

曹安源 Anyuan Cao
Title: Growth, Structure and Properties of Carbon Nanotubes
Professor at Department of Advanced Materials and Nanotechnology, College of Engineering, Peking University

Research Profile

The overall objective of the research in our group is to understand basics of nanostructures and nanodevices, and explore potential applications of nanotechnology.

One-dimensional nanostructures such as nanotubes and nanowires have excellent mechanical, electrical and optical properties. Their properties are strongly related to the crystalline structure, diameter, length and surface functionalities. Therefore, synthesis of nanomaterials with controlled morphology and properties is essential for making high performance nanodevices and integrated systems. Our group is working on growth of carbon nanotubes in individual long tubes, thin films, arrays and yarns, and semiconducting nanowires and hybrid structures.

Assembly of nanostructures is an important step toward applications. We develop self-assembly methods to align nanotubes/nanowires over large area with tailored distribution. The blown bubble film technique can assemble a wide range of 1D nanomaterials, and might be scaled up for low-cost industrial production using blown film extrusion techniques.

We pursue applications in energy and environmental areas. Nanostructure-incorporated photovoltaics have been developed such as CNT-Si, graphene-Si, CNT- Si nanowire, CNT-CdSe nanowire, and polymer solar cells with CNT film as transparent electrodes. Current challenge is to further improve device efficiency while reduce cost. CNT sponges consisting of a 3D interconnected nanotube network show great flexibility, and strong absorption of organic molecules and oil. They can remove nanoparticles and organic contaminants from water like a filter, promising applications in environmental cleanup and water purification.

张艳锋 Yanfeng Zhang
Title: Graphene and its heterostructures: controlled growth, characterizations and applications
Professor at Department of Advanced Materials and Nanotechnology, College of Engineering, Peking University Center for Nanochemistry, Beijing University

Research Profile

The research topics in Dr Zhang’s group are the fabrication of low dimensional materials such as metal thin films, high quality graphene etc, and the investigation of their atomic structures, electronic structures and novel physical/chemical properties.

In general, the techniques involved in these researches are scanning tunneling microscope (STM), atomic force microscope (AFM), angle resolved photoemission spectroscopy (ARPES), Raman spectroscopy and so on.

Now, we are studying atomic structures and electronic properties of graphene prepared using various methods such as chemical vapor deposition on metal foils or single crystals, and thermal decomposition of SiC(0001). We further investigate the fundamental growth mechanisms of graphene at the as-grown states by STM. Moreover, we research the assembly of organic molecules on few layer graphene for modifying the carrier mobility and the unique size effects. We also fabricate some novel systems like magnets /graphene and organism/graphene for exploring their unique electronic, magnetic and transport properties.

2. *Lab tours*

13:30-14:00 Prof. Yan Li's Lab @CCME
http://old.chem.pku.edu.cn/liy/labhomepage/eng-index.html

14:00-15:00 Prof. Zhongfan Liu's Lab & Prof. Jin Zhang's Lab @CCME
http://www.chem.pku.edu.cn/cnc/cn/

15:00-15:30 Prof. Kaihui Liu's Lab @School of Physics
http://www.phy.pku.edu.cn/~khliu/home.html

15:30-16:00 Prof. Lianmao Peng's Lab @ School of electronics engineer and computer science
http://nano.pku.edu.cn/StaffHome.aspx?person=1

16:00-16:30 Prof. Anyuan Cao's Lab @ college of Engineering
http://www2.coe.pku.edu.cn/subpaget.asp?id=333

3. *Grouping*

You are suggested to form 5 teams x 4 people. Please make team freely, but each team is suggested to have 2 PKU students and 2 UTokyo students. A team with all Chinese is not allowed. Furthermore, each team should have at least one female student.

4. *Students presentation*

All the student participants from both China and Japan side will be asked to give a 5 min presentation including your self-introduction and research direction (afternoon of 5th). You are advised to come a bit earlier to test the functioning of your ppt file.

5. *Final presentation*

Each team proposes a potential collaborative project between PKU and UTokyo
Topic should be related but not limited to Nano-carbon research
Each team gives a 15 min presentation on their proposal. (10 min talk + 5 min Q&A)
All members of a team need to present, and the contributions of each member need to be clarified at beginning of the presentation.
Each team needs to submit one page summary (format not limited), as well as their presentation PowerPoint for final score.

6. *Participants*

Name	Kanji	Affiliation	Supervisor	e-mail
Shigeo Maruyama	丸山 茂夫	The University of Tokyo		maruyama@photon.t.u-okyo.ac.jp
Rong Xiang	项 荣	The University of Tokyo		xiangrong@photon.t.u-tokyo.ac.jp
Il Jeon	田 日	The University of Tokyo		jeon@photon.t.u-tokyo.ac.jp
Yan Li	李 彦	Peking University		yanli@pku.edu.cn
Juan Yang	杨 娟	Peking University		yang_juan@pku.edu.cn
Anyuan Cao	曹安源	Peking University		anyuan@pku.edu.cn
Yanfeng Zhang	张艳锋	Peking University		Yanfengzhang@pku.edu.cn
Feng Yang	杨 烽	Peking University		fengyang@pku.edu.cn
Lianming Tong	童廉明	Peking University		tonglm@pku.edu.cn
Hao Gong	龚浩	The University of Tokyo	Takuzo Aida	hao.gong@riken.jp
Steven Osma	オズマスティーブン	The University of Tokyo	Jean-Jacques septemeber	ozuma@g.ecc.u-tokyo.ac.jp
Shoko Yokokawa	横川翔子	The University of Tokyo	Shinji Yamashita	yokokawa@cntp.t.u-tokyo.ac.jp
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Muhammad Muflikhun	ﾑﾌﾘｸﾝ ﾑﾊﾏﾄﾞ ｱｸｼﾝ	The University of Tokyo	Takahira Aoki	akhsin.muflikhun@ugm.ac.id
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Hao Zhang	张浩	Peking University	Liangbing Gan	Zhchem@pku.edu.cn
Liangwei Yang	杨良伟	Peking University	Jin Zhang	yanglw-cnc@pku.edu.cn
Yi Chen	程熠	Peking University	Zhongfan Liu	chengyi-cnc@pku.edu.cn
Bei Jiang	姜蓓	Peking University	Zhongfan Liu	jiangbei-cnc@pku.edu.cn
Liusi Yang	杨柳思	Peking University	Anyuan Cao	youngliusi@pku.edu.cn
Yunong Xie	谢雨农	Peking University	Liaomao Peng	rowenia@163.com
Huiwen Shi	石惠文	Peking University	Lianmao Peng	shw201206@126.com
He Ma	马赫	Peking University	Kaihui Liu	hema@pku.edu.cn

Abstract

Synthesis and characterization of low dimensional materials

Hayato Arai[1], Shigeo Maruyama[1,2]

[1] The university of Tokyo, Department of Mechanical Engineering, [2]National Institute of Advanced Industrial Science and Technology (*AIST*)

arai@photon.t.u-tokyo.ac.jp

My research topic is synthesis and characterization of low dimensional materials(such as, graphene, h-BN, carbon nanotube) and heterostructure of these materials. In particular, I'm working on the synthesis of graphene/h-BN stacking heterostructure. As you all know, graphene and CNT have prominent properties, such as, carrier mobility, thermal conductivity and mechanical strength. But in most cases, properties of these nano carbon materials can be used fully due to the effect of impurity or substrate. Therefore, h-BN has been attracting an interest as a substrate or protective coating material of nano carbon because h-BN has ultra-flat and dangling-bond free structure. So far, Some reported that h-BN substrate or coating enhance the properties drastically.

I'm trying to synthesize graphene/h-BN vertical heterostructure with sequential CVD method so that no impurity intercalation would occur. In addition, I began growth of carbon nanotube wrapped with h-BN layer recently. This BN coating technique is useful for protecting carbon nanotube from oxidation or other chemical damages.

Self-introduction

Hayato Arai (Utokyo, Mechanical Engineering, M1)

Year : 23,

Hometown : Chiba, Japan

Hobby : cat café, weight training

Bottom-up Synthesis of Graphitic Carbon Nitride

Hao Gong[1,2], Daigo Miyajima[2], Takuzo Aida[1,2]

[1] Department of Chemistry and Biotechnology, School of Engineering, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656, Japan.

[2] RIKEN Center for Emergent Matter Science, 2-1 Hirosawa, Wako, Saitama 351-0198, Japan.

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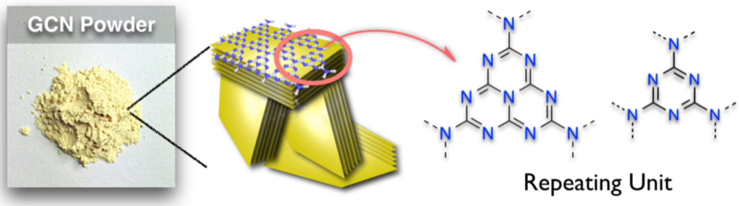


Fig 1. Schematic illustration of GCN

Graphitic carbon nitride (GCN) has been intensively studied as a metal-free photo-catalyst in the last decade since the discovery of its water splitting ability by Domen et al. (*Nat. Mater*. **2009**, 8, 76; cited more than 3,500 times). However, despite a large number of the reports on GCN since the first report on its synthesis (*Ann. Pharm.* **1834**. 10, 1–47), even basic physical properties of GCN have not yet been well investigated by experiments except for theoretical calculations due to the lack of reproducible and well-controlled synthetic method. The chemical structures of GCN materials are considered to be based on one of the two building blocks: the triazine (C_3N_3) and the heptazine (C_6N_7) cores (**Fig. 1**) (*Nat. Rev. Mater.* **2017**. 2.6. 17030). The primary goal of my project is to develop an alternative synthetic method of GCN and develop their new applications. So far, I already established the bottom-up synthesis method to access cyclic triazine trimer (CTT), which is the unreported smallest functional repeating unit of fully condensed GCN.

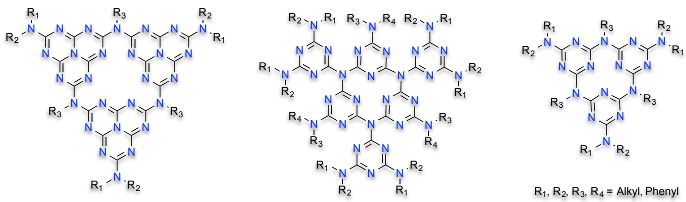


Fig 2. Possible Target Molecules of nano-GCN

Self-introduction

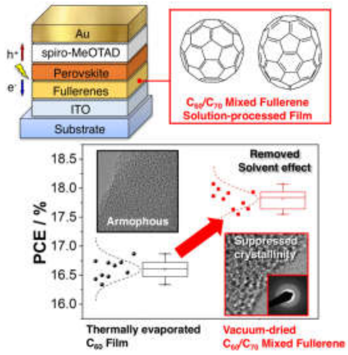
My name is Hao Gong, and I was born in Jiangxi Province, China, on October 1994. I received my B.S. in the group of Prof. Jiao-bing Wang in Department of Chemistry at the Sun Yat-Sen University, Guangzhou, China in 2016. I started my Master course in the group of Prof. Takuzo Aida at the University of Tokyo, Japan in 2017 on supramolecular chemistry materials. My interests are chemistry, music and automobile.

Achieving High Efficiency in Solution-Processed Perovskite Solar Cells using C_{60}/C_{70} Mixed Fullerenes

Hao-Sheng Lin[1], Il Jeon[1], Shigeo Maruyama[1], Yutaka Matsuo[1]

[1] Department of Mechanical Engineering, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-8656, Japan

linhaosheng@photon.t.u-tokyo.ac.jp



Fullerenes have attracted considerable interest as an electron transporting layer in perovskite solar cells. Fullerene-based perovskite solar cells produce no hysteresis and do not require high-temperature annealing. However, high power conversion efficiency can only be achieved when the fullerene layer is thermally evaporated, which is an expensive process. In this work, the limitations of a solution-processed fullerene layer have been identified as high crystallinity and the presence of remnant solvents, in contrast to a thermally deposited C_{60} film, which has low crystallinity and no remaining solvents. As a solution to these problems, a mixed C_{60} and C_{70} solution-processed film, which exhibits low crystallinity, is proposed as an electron transporting layer. The mixed-fullerene-based devices produce power conversion efficiencies as high as that of the thermally evaporated C_{60}-based device (16.7%), owing to improved fill factor and open-circuit voltage. In addition, by vacuum-drying the mixed fullerene film, the power conversion efficiency of the solution-processed perovskite solar cells is further improved to 18.0%. This improvement originates from the enhanced transmittance and charge transport by removing the solvent effect. This simple and low-cost method can be easily used in any type of solar cells with fullerene as the electron transporting layer.

Self-introduction

Hao-Sheng Lin was born in Hunan province of China, a D1 student under supervision of Prof. Maruyama and Prof. Matsuo in the University of Tokyo. My current major is the perovskite solar cells and development of solar cell related materials by applying the organic synthesis among the carbon cluster materials. I have variety of interests, such as guitar, violin and photography. I wish I could meet you in wherever Beijing or Tokyo.

Synthesis and Catalytic Application of Gold Clusters Supported on Nitrogen-Doped Mesoporous Carbon

Wei Loon Lim,[1] Shinjiro Takano[1], Feng Liang[1,2], Tatsuya Tsukuda[1,3]

[1] Graduate School of Science, The University of Tokyo

[2] The State Key Laboratory of Refractories and Metallurgy, Wuhan University of Science and Technology

[3] Elements Strategy Initiative for Catalysts and Batteries, Kyoto University

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We had demonstrated that gold clusters stabilized by polymers showed aerobic oxidation catalysis when their diameters were below 2 nm and proposed that negative charge on the Au clusters be the key for the catalytic activation of O_2 [1]. Although polymer-stabilized Au clusters exhibited high catalytic activity, there is yet room for improvement for practical use: easy collection and high durability are essential. Therefore, my research aim is to develop Au cluster-based heterogeneous catalysts with atomically-precise size, high activity and high durability. Toward this goal, I focused on nitrogen (N)-doped carbon materials as support of Au clusters with the expectations that stability of Au clusters against aggregation will be enhanced and the electronic states can be modulated by interaction with N sites of different natures [2]. I have synthesized nitrogen-doped mesoporous carbon with tunable N-doping and surface area by high-temperature carbonization of the iso-reticular metal-organic framework according to the reported method [3]. Immobilization of size-selected Au clusters on nitrogen-doped mesoporous carbon for catalytic studies is underway by using ligand-protected atomically-precise Au clusters as starting material.

[1] H. Tsunoyama, *et al. J. Am. Chem. Soc.* **2009**, *131*, 7086.

[2] Y. Cao, *et al. ACS Catal.* **2017**, *7*, 8090.

[3] J. Jeon, *et al. ACS Appl. Mater. Interfaces* **2014**, *6*, 7214.

Self-introduction

Lim Wei Loon. Upon graduation from Universiti Sains Malaysia, I came to Japan seeking to learn the traditional music instrument unique to Japan – Shakuhachi. Meanwhile, I was accepted into The University of Tokyo, under Prof. Tsukuda Tatsuya's supervision, working on catalytic studies of gold clusters supported on nitrogen-doped carbon materials. Coming from a multi-racial country, I speak multiple languages fluently, including English, Chinese, Japanese, and more.

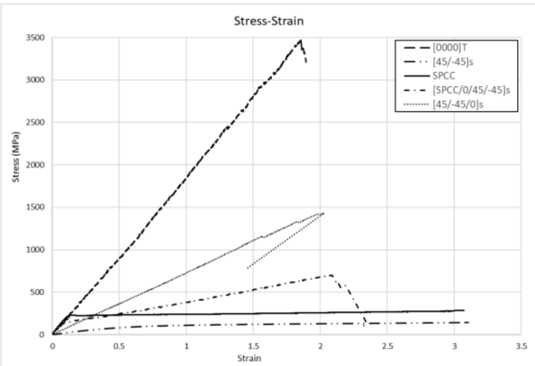
Stacking Sequence Optimization of CFRP-SPCC Hybrid Laminates for Automotive Applications

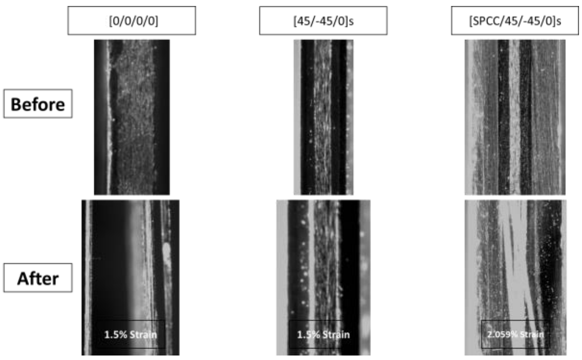
Muhammad Akhsin Muflikhun[1,2], Takahira Aoki[1]

[1] Department of Aeronautics and Astronautics, The University of Tokyo, Japan [2] Mechanical and Industrial Engineering Department, Universitas Gadjah Mada, Indonesia

akhsin.muflikhun@ugm.ac.id

The use of Carbon Fiber Reinforced Polymer (CFRP) to strengthen structure in automotive applications is increasing rapidly. The specific area in which the method has lately been presented is the strengthening of steel plate with CFRP laminates. The purpose of this research is to experimentally identify the effect of hybridization between CFRP-SPCC properties under quasi-static loading. The different number of layers and stacking sequences of CFRP were used in this research followed by combination of strain gauges to determine the stress-strain graph. The result reveals that different stacking sequences and combinations of CFRP-SPCC laminates are the significant effects on the failure mode behavior of the laminates.





Self-introduction

Hi, My Name is Muhammad **Akhsin** Muflikhun. I come from Yogyakarta, Indonesia. I am 30 years old and a lecturer in Universitas Gadjah Mada, Indonesia. Currently I am doing my 2nd year of my PhD in the department of Aeronautics and Astronautics, The university of Tokyo, japan. Previously I studied Graphene-silver-titanium dioxide nanocomposites materials when in my master. My research topic now is about combining CFRP and SPCC steel and try to make hybrid laminates that will applied in automotive structures.

Study Of Whispering Gallery Modes (WGM) In Light-bulb Shaped Microresonators For Use As Biosensors

Steven James Osma[1], Jean-Jacques Delaunay [1]
[1] The University of Tokyo
ozuma@g.ecc.u-tokyo.ac.jp

Repeated cancer screening tests are often encouraged by medical professionals. This is due to the general consensus that the earlier one detects a malignancy or premalignancy, the more likely cancer treatment will be effective. Certain 'labeling' fluorescent biosensors have been found to contribute to the issue of misdiagnosis. Therefore, it has been of recent interest to study a particular 'label-free' microsensor known as Whispering Gallery Mode (WGM) microresonators. WGM microresonators have the property to trap very narrow frequencies of light and is dependent highly on its geometry and effective refractive index. For use as a biosensor, WGM microresonators are usually coated with a ligand that bonds specifically to the biomolecule to be detected. If the WGM microresonator with the ligand coating is put in contact with cancer molecules, a chemical reaction will occur on the ligand and the diameter of the WGM microresonator will change along with its effective refractive index. This will change the frequency of light that light can be trapped into the microresonator and allow the microresonator to be selective to cancer bacteria at the single molecular level. My research tries to design a new cancer biosensor using a light-bulb shaped geometry of the WGM microresonator. This new geometry provides the potential to detect cancer cells more sensitively and more simply compared to the current WGM biosensors in the market by measuring the light in the microresonator directly. My research hopes to provide a cheaper and simpler alternative cancer detecting biosensor that doesn't suffer from the issue of misdiagnosis patients found in other biosensors.

Self-introduction

I am Steven James Osma. I am originally from New York City in the United States of America. I completed my undergraduate at New York University and now completing my masters at the University of Tokyo. My hobbies include traveling, reading, swimming and listening to classical music.

Measurement of bundle size dependent thermal conductivity of suspended single-walled carbon nanotubes

P. Wang[1], T. Inoue[2], R. Xiang[3], S. Maruyama[3]

[1]Dept. of Mech. Eng., the Univ. of Tokyo, 7-3-1 Hongo, Bunkyo, Tokyo 113-8656

wangpyk@photon,t,u-tokyo.ac.jp

Single-walled carbon nanotubes (SWNTs) have been widely studied for electronic applications, but the working stability and durability of SWNTs electronics are highly dependent on thermal behavior of SWNTs. Similar with graphene, bundled SWNTs shows suppressed thermal property compared with isolated SWNTs. Experimental results assumed to stem from the phonon-phonon interaction between SWNTs, while simulation works reach no agreement on the inter-tube effect on thermal conductivity of SWNTs.

In order to investigate the relationship of isolated single-walled carbon nanotube (SWNT) and its nanoscale structure, an experiment is conducted to investigate the bundle effect on thermal properties of SWNT with suspended thermometer. Thermal conductivity of isolated SWNTs and SWNT bundles of different sizes are measured under temperature range from 78K to 410K. The results show that bundle effect confines thermal transport in SWNT and inter-tube scattering in SWNT bundles is enhanced with increasing bundle size. Compared with isolated SWNT, thermal conductivity of bundles consist of three, eight and thirteen SWNTs drops by 75%, 95% and 97%, respectively.

Self-introduction

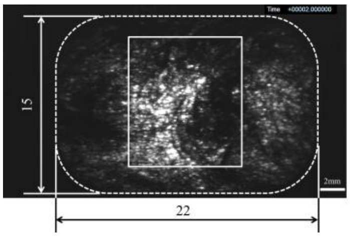
Hi, I’m Pengyingkai Wang from Luoyang, China. Now a first year PhD student at the University of Tokyo. My research is about thermal properties measurement of low-dimensional materials, like carbon nanotube. When not working, I enjoy painting, travelling, and reading.

Evaluation of Disintegration and Distribution of Long Carbon Fiber Bundles in Pellets inside Melts Injected from Molding Machine Nozzle

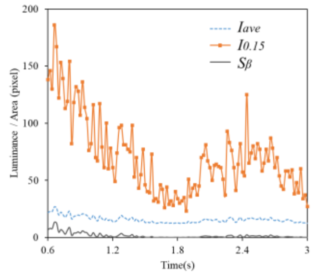
XIAOBIN WU[1], SHIGERU OWADA[2], HIDETOSHI YOKOI[3]

[1] gosyoubinn@gmail.com, [2] showada7@iis.u-tokyo.ac.jp, [3] hiyokoi@iis.u-tokyo.ac.jp

Carbon long fibers are extensively used as important industrial materials due to their excellent mechanical properties. However, when long carbon fiber reinforced resins are ejected from the nozzle by the injection molding method, the problem of incomplete fiber disintegration often occurs. Specifically, this phenomenon occurs during the plasticization of the resins inside the heating cylinder by the screw as well as when the resins pass by the screw check ring and through the narrow channel of the nozzle [1]. When resins containing such incompletely disintegrated fibers fill into the mold cavity, they cause reduced accuracy and mechanical strength of molded products as well as appearance problems. In this study, we aimed to develop a method for injecting plasticized resins from the nozzle in the reciprocating screw plastication process, quantitatively evaluate the dispersibility of long fibers in injected resins, and confirm the effectiveness of this method.



Observation image (Evaluation area: 420×480pixel)



Change with time of Luminance $I_{0.15}$ at 0.15% pixel point, Area S_β over luminance 41, and Average luminance I_{ave}

REFERENCES

1.Hidetoshi Yokoi, Nobuaki Iguchi, Koji Ueda, "Visualization of mixture of resin pigments in glass-inserted resin mixture evaluation mold", JSPP'91 Tech. Papers, 213-216 (1991)

Self-introduction

I come from China. My hometown Dalian is a coastal city like Tokyo. I graduated from Dalian University of Technology and now studying at the University of Tokyo. I like playing piano(I have studied for more than 8 years), watching anime and looking for delicious food.

Potentials of Carbon Nanotube toward Biomedical Applications

Shoko Yokokawa[1], Sze Y. Set[1], Shinji Yamashita[1]
[1] The University of Tokyo, Research Center of Advanced Science and Technology
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In recent years, engineered nanomaterial, which is expected to use for medical applications, have attracted researchers. Carbon nanotubes (CNTs) are one of the attracted nanomaterial suitable for biomedical application, since their bonding strength is the strongest among human made material so far, and they have good terms with biomolecules, such as DNA and proteins. For example, CNTs are used for restoration of broken or cancellous bone. As human get older, the risk to suffer from osteopenia and osteoporosis become higher. Main symptom is that bone density gets low and easily gets fractured. The idea is to reinforce these bones using CNT. The bone density varies between 0 to 43 % minerals content by volume. Since it is capable to adjust the density of carbon in CNT by changing concentration of solution, it is possible to customize that fits each person and each damage point.

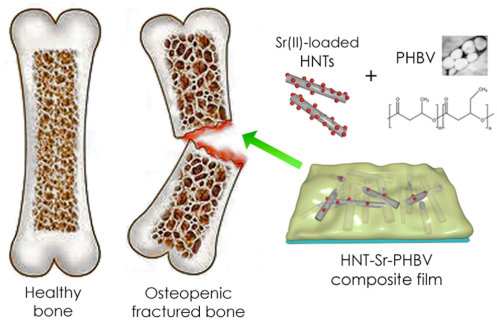

Fig.1 Image of healthy bone, osteopenic fractured bone

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Self-introduction

Hi, my name is Shoko Yokokawa, first year of master course in the University of Tokyo. My hometown is Hyogo prefecture, which is about 3 hours from Tokyo. My research topic is laser source for multiphoton microscopy. I'm interested in biophysics and biomedical engineering.

My hobby is reading books, sightseeing, and listening to music.

Template-directed synthesis of coaxial structure of single-walled carbon nanotubes and boron nitride nanotubes by chemical vapor deposition

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Graphene/h-BN interfaces have generated great interests recently due to the possibility of combining diverse atomic layers to create novel materials and devices. In this work, we demonstrate a coaxial structure with similar interfaces that combines the single-walled carbon nanotubes (SWCNTs) with boron nitride nanotubes (BNNTs) in the radial direction. Ammonia borane (BH_3NH_3) as precursor was directly used to successfully synthesize BNNTs with the aid of SWCNTs as a template by a facile chemical vapor deposition (CVD) technique. Absorption spectra and Raman spectra confirmed not only the formation of BNNTs from BH_3NH_3, but also the undamaged condition of SWNTs. Furthermore, scanning electron microscopy (SEM) and transmission electron microscopy (TEM) were employed to examine the morphology and quality of the coaxial structure. With 30 min BH_3NH_3 growth, the number of walls increased to 3-5 with the diameter of ~5 nm wide. We believe this structure will have a broad interest and impact in many fields, which include but not limited in investigating the intrinsic optical properties of environment-isolated SWCNTs, fabricating BN-protected or gated SWCNT devices and building more sophisticated 1D material systems. It can also be used for photovoltaics and light-emitting devices when combining transition metal dichalcogenide monolayers (TMDC) materials.

Self-introduction

I received my Bachelor's Degree in Materials Physics at South China Normal University (SCNU) in 2014. With my excellent academic performance and research experience, I was officially recommended by SCNU for admission to Sun Yat-sen University, where I pursued my Master Degree in Optical Engineering in 2014-2017. At present, I am pursuing Doctoral degree in Mechanical Engineering from The University of Tokyo and working in preparation and application of 1 dimensional SWCNT@BNNT structure supervised by Prof. Maruyama.

Field-driven Ultrafast Electron Emission from Carbon Nanotube

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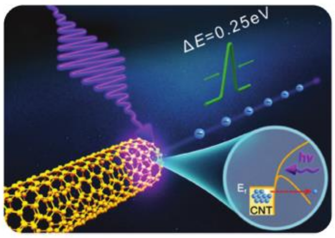
Ultrafast electron pulses, combined with laser-pump and electron-probe technologies, allow ultrafast dynamics to be characterized in materials. However, the pursuit of simultaneous ultimate spatial and temporal resolution of microscopy and spectroscopy is largely subdued by the low monochromaticity of the electron pulses and their poor phase synchronization to the optical excitation pulses. Field-driven photoemission from metal tips provides high light-phase synchronization, but suffers large electron energy spreads (3–100 eV) as driven by a long wavelength laser (>800 nm).

Ultrafast electron emission from carbon nanotubes (≈1 nm radius) excited by 820 and 410 nm femtosecond laser is realized in the field-driven regime. In addition, the emitted electrons have great monochromaticity with energy spread as low as 0.25 eV. The new nanotube-based ultrafast electron source opens exciting prospects for extending current characterization to sub-femtosecond temporal resolution as well as sub-nanometer spatial resolution.



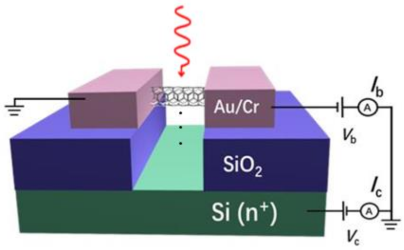


Figure 1) Dynamics of highly coherent CNT-based photoemission source dynamics 2) Schematic structure of individual CNT emission device

Self-introduction

I am He Ma, and you can call me Mach. I was born in Heilongjiang province, northeast of China,in which place people are famous for their expansive and extravagant. Now I am a graduate student from Prof. Kaihui Liu's lab of Peking University. We are now working on optical field electron emission, and if you are also interested in these fields, I will be very happy to discuss with you. I'm an outgoing person but sometims may be very quite,so I can be both a speaker and a good listener as well.

Strong Graphene Adhesion Enables Glue Application and Assembly of Suspended Wrinkles

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Graphene has a two-dimensional (2D) planar structure with high flexibility, which leads to conformal contact and adhesion. Here, we utilize the strong adhesion generated between solution precipitated graphene oxide (GO) sheets and selected substrates, to explore two novel applications: 1) a conductive non-penetrating GO glue for making functional vertical architectures, and 2) assembly of suspended GO wrinkles with high pre-tension and elastic properties.

In the first application, we show that a GO solution can glue 3D porous carbon nanotube (CNT) sponges and their composites onto rigid or flexible substrates. Mechanical tests and theoretical calculation based on van der Waals interaction reveal high adhesion strengths at the interfaces. Taking the reduced GO (rGO) glue as a thin layer electrode, we utilize the rGO-fixed CNT sponge as a porous template to fabricate polymer-reinforced, vertical composite columns, which exhibit high conductivity and super-elastic behavior.

In addition to solid substrates, we further utilize a liquid TiO_2 gel to modify the local structure of GO films and create suspended, aligned wrinkles with tailored wavelength. In particular, those GO wrinkles are subject to a high pre-tension, which is important for making stable suspended configurations, as confirmed by theoretical calculations based on the wrinkle geometry and measured spring constants, respectively.

Self-introduction

Currently, I am a Ph. D. candidate under the supervision of Prof. Anyuan Cao in Materials Science and Engineering at college of engineering in Peking University. I was born on August 1993 in Hunan province. My favorite sport is table tennis, and I play table tennis almost every week. I have many hobbies, such as travelling, listening to music, doing handwork and so on. I believe "Everything will be alright in the end, if it's not alright, it's not yet been the end."

Carbon nanotube supported carbon-nitrogen-iron hybrids as bifunctional electrocatalysts for Zn-air batteries

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Replacing precious and nondurable noble-metal catalysts by economical and commercially available materials in the oxygen reduction reaction (ORR) and oxygen evolution reaction (OER) is a key issue to be addressed in metal–air batteries. Here, we synthesized a novel bifunctional electrocatalyst of atomically dispersed iron-nitrogen-carbon species anchored on carboxylic carbon nanotubes (Fe-NC/OCNT) by pyrolizing OCNT-templated zeolitic imidazolate framework (ZIF). The addition of carbon nanotubes strung Fe-NC active species into a network and enhance the overall electrical conductivity. This catalyst showed excellent ORR performance with a half-wave potential ($E_{1/2}$) of 0.86 V, as well as a low overpotential for OER， which outperformed commercial Pt-C. Especially, when assembled into Zn-air batteries, high power density (187 mW cm^{-2}) and stable discharge-charge cycling platforms were achieved. This superior performance was attributed to the synergistic effect of distinctive CNT core and Fe-NC shell structures, in terms of fast electron transport and abundant high-active sites. This work provides a general method to optimize ZIFs derived materials to substitute for noble-metal catalysts for air cathodes in Zn-air batteries.

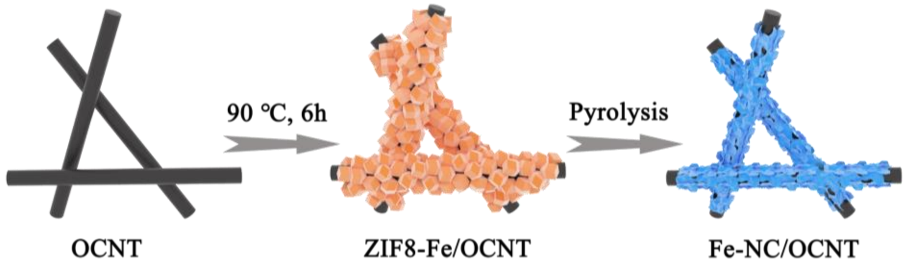

Fig. 1 Schematic illustration for the preparation of Fe-NC/OCNT hybrids.

Self-introduction

My name is Jian Sheng, 23 years old, from Shandong province, China. I finished my undergraduate education in Nankai University, majoring in materials chemistry in the college of chemistry. Now I continue to study in professor Yan Li's group. My research direction is the application of carbon nanotubes in energy storage and conversion.

Single-Walled Carbon Nanotubes Individually Dispersed by a Low-Cost Natural Product Solution

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The individual dispersion of single-walled carbon nanotubes (SWNTs) is important for the applications in electronics, optics and nanodivices. Here, we report a low-cost dispersion of SWNTs using a natural product baicalin (BC) solution. The well resolved absorption and photoluminescence (PL) spectra indicate that the SWNTs are dispersed individually by BC. Moreover, we observe significantly enhanced PL intensities after adding La^{3+} into the dispersion whereas the absorption intensity does not change, suggesting a significantly enhanced quantum yield of SWNTs.

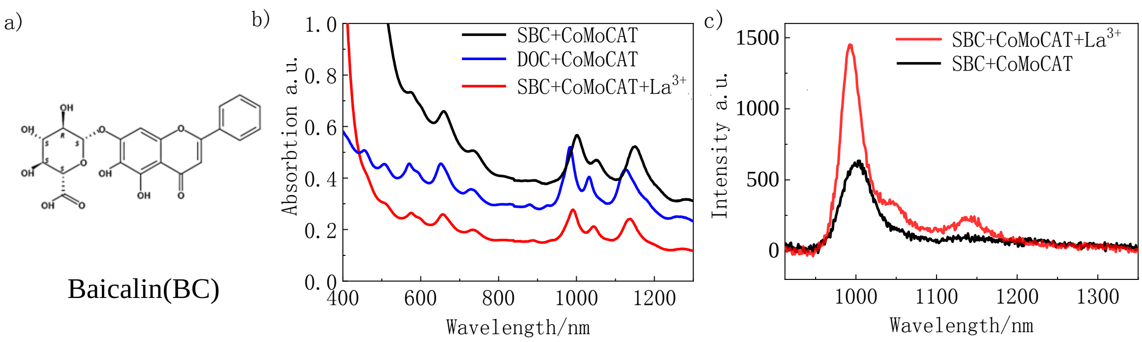

Fig.1 a) Structure of baicalin (BC). b) Absorption spectra of CoMoCAT dispersed by sodium baicalin (SBC, NaOH: BC=1:1), sodium deoxycholate (DOC) and SBC+La^{3+}. c) Photoluminescence emission spectra of CoMoCAT dispersed by SBC and SBC+La^{3+}, excited at 575 nm.

Self-introduction

My name is Guodong Jia, I'm from Shanxi province, China. After study for four years at Tongji University, I got my bachelor degree. Now I'm studying at Professor Yan Li' group, Peking University. In my spare time, I'd like to go to movies, reading novels, etc. I'm glad to be friends of every one of you.

High Brightness Blue Light-Emitting Diodes Enabled by Directly Grown Graphene Buffer Layer

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Single-crystalline GaN-based light-emitting diodes (LEDs) with high-efficiency and long lifetime are the most promising solid-state lighting source compared with conventional incandescent and fluorescent lamps. However, the lattice and thermal mismatch between GaN and sapphire substrate always induce high stress and high density of dislocations and thus degrade the performance of LEDs.

Herein, we present the growth of high-quality GaN with low-stress and low density of dislocations on graphene (Gr) buffered sapphire substrate for high-brightness blue LEDs. The introduced Gr buffer layer greatly releases biaxial stress and reduces the density of dislocations in GaN film and $In_xGa_{1-x}N$/GaN multiple quantum well structures. The as-fabricated LED devices therefore deliver much higher light output power compared to that on bare sapphire substrate. The GaN growth on Gr buffered sapphire only requires one-step growth, which largely shortens the MOCVD growth time. This facile strategy may pave a new way for applications of Gr films and bring several disruptive technologies for epitaxial growth of GaN film and its applications in high-brightness LEDs.

Self-introduction

I am Bei Jiang, a 23-year-old girl from Yantai, Shandong Province. I obtained my Bachelor of Science in Chemistry from Taishan College, Shandong University, China in 2013. At present, as a Ph.D. student in Physical Chemistry, I am being trained in the team of Professor Zhongfan Liu at the Center for Nanochemistry, Peking University. My research interests center on controlled synthesis and applications of graphene on insulating substrates.

Direct CVD Graphene Growth on optical fibers

Yi Cheng[1], Ke Chen[1], Kaihui Liu[1,2*], Zhongfan Liu[1*]

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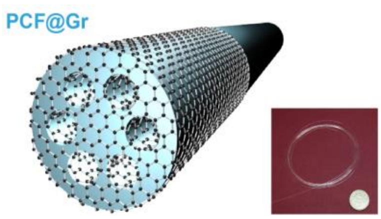
Graphene exhibits broad prospects for its potential application in multifarious fields, like photoelectronic, energy storage and catalysis, owing to its unique structure and excellent properties. Up to now, chemical vapor deposition (CVD) on metallic substrates has been widely used for scalable production of high-quality graphene. However, the as-fabricated graphene needs to be transferred onto target substrates for further fabrication of graphene-based electronics. This process inevitably results in contamination, wrinkling, and breakage of graphene samples, which is not compatible with industrial applications. Meanwhile, it is difficult to transfer a complete graphene film onto some special-structured substrates. Therefore, direct CVD graphene growth on desired insulating substrates is considered as an effective alternative to combine graphene with the functional substrates.



Thus, we develop a facile way to grow graphene on porous photonic crystal fiber by chemical vapor deposition. The left figure shows the schematic of graphene growth on the fiber. Based on the interaction between graphene and light, this fiber can realize electro-optic modulation with a voltage lower than 3 V.

Self-introduction

My name is Cheng Yi, 22 years old, born in Chizhou, Anhui province, China. I got my BS degree from Department of Material Science in Fudan University and have been a PhD candidate of Center for Nanochemistry in Peking University for almost one year. Currently, my research field is graphene growth on insulating substrates and its application in optical devices. In my spare time, I like travelling, playing sports with my friend as well as reading some literary works.

Simple Synthesis of Vertical Graphene/TiO_2 Nanoparticles Composites via Microwave Oven for Li-Ion Battery Anodes

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Energy, is one of three key issues in the modern society. Li-ion batteries (LIB), has several advantages of high speed, stable and low density, are being considered as the leading candidates for electrochemical energy storage. However, the anode materials of LIB are limited by slow Li-ion diffusion, poor electron transport and increased resistance at the interface, which leads to inhibition of charge-discharge rates. TiO_2 attracts much attentions to be the potential anode material of LIB because of its abundant, low cost and environmental protection. To decrease the interfacial resistance, we can introduce conductive coating materials. Recently, our group realizes the vertical graphene encapsulated TiO_2 nanoparticles are prepared with reconfigured domestic microwave oven. The TEM and Raman results show vertical graphene uniformly grows on the surface of TiO_2 nanoparticles. And XRD and XPS spectras show pristine anatase TiO_2 also maintains its crystal structure. Compared with pristine TiO_2, the cycle stability of vertical graphene/TiO_2 significantly improves on the vertical graphene/TiO_2 anode material.

Self-introduction

My name is Liangwei Yang, 26 years old. My hometown is Hebei province, China. I graduated from the Lanzhou University with B.S. degree in Chemistry in 2013. I am a doctoral candidate in the College of Chemistry and Molecular Engineering (CCME) at Peking University. My research mainly focuses on carbon nanochemistry to synthesize graphene and single-walled carbon nanotubes and explore their interesting applications, including Li-ion batteries and composite materials.

Interface state density Characterization in CNTs thin film transistors with Y_2O_3/HfO_2 gate dielectric

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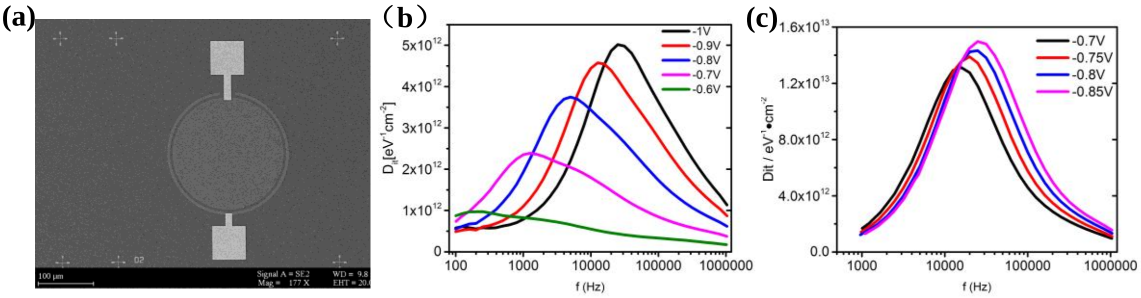

Figure 1| Characterization of the Y_2O_3/HfO_2 dielectric in CNT TFTs. (a) The SEM image of fabricated circular capacitance of metal-oxide-CNT film structure with radius of 100μm for CV measurements. (b) The typical interface traps density(Dit)-frequency(f) curves of MOS structure with 10 nm Y_2O_3 gate dielectric at different V_{gs}. (c) The typical D_{it}-f curves of MOS structure with 10 nm HfO_2 gate dielectric at different V_{gs}.

Wafer-scale fabrication of transistors is prerequisite for the applications of carbon nanotube (CNT) based electronics. As is well known, gate dielectric is the key component of a FET since it significantly affects both on-state and off-state properties of the FETs, including transconductance and subthreshold swing. Here, we extract the interface traps density (D_{it}) in fabricated carbon nanotube thin film transistors (TFT) by conductance method and the average interface states density of CNT TFTs with Y_2O_3 and HfO_2 gate dielectric are 5.02×10^{12} cm^{-2} and 1.45×10^{13} cm^{-2}.

Self-introduction

Hi, I am Shi huiwen, a Ph.D Student from Peking University. This year is my chinese zodiac anniversary year (two cycles) which means I am 24. I was born in Henan Province. Now I major in Physical Electronics, specifically, the Carbon nanotube Electronics. In my spare time, swimming and Running are my favorite sports. I am also a big fan of Japan anime, like One Piece, Attack on Titan, etc. I like to make friends and hope to make friends in the camp.

High performance Random-CNT-film-based Transistors and ICs

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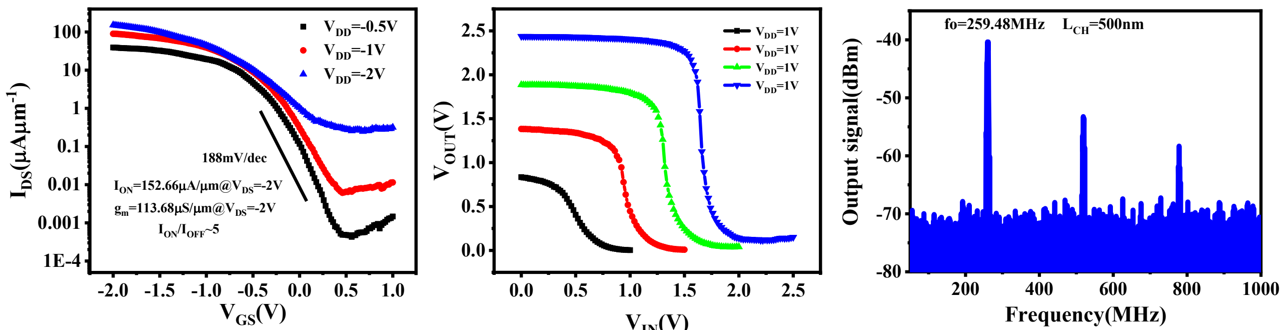
As the cornerstone of modern integrated circuits, silicon-based CMOS technology will reach its physical and technical limits at 7 nm or 5 nm technology nodes [1], and carbon nanotube-based electronics are considered to be one of the potential alternatives for silicon-based CMOS technology [2]. We adopt doping-free process to fabricate high-performance p-type (Pd-contacted) FETs with random CNT films as the channel material. For FETs with a gate length of 500nm, the on-current I_{ON} and transconductance g_m can reach 152.66μA/μm and 113.68μs/μm. Based on our high performance FETs, p-logic inverter and five-stage ring oscillator are further fabricated. The inverter shows rail-to-rail output characteristics for cascading and a voltage gain of up to 20. Moreover, the RO with a oscillation frequency of 259.48MHz exhibits the potential of carbon nanotube in high-speed applications for the future.



【1】 M. M. Waldrop, The chips are down for Moore's law, *Nature*, 2016, 530, 144

【2】 G. S. Tulevski, *et al.*, Toward high-performance digital logic technology with carbon nanotubes, *ACS Nano*, 2014, 8, 8730

Self-introduction

Yunong Xie is 24 years old from Zhejiang, China. She received the bachelor degree from Jilin University in 2016. Currently she is in Institute of Physical Electronics, Peking University for the doctor degree. She likes running and reading in spare time and welcomes to communicate with her.

Side Selective Coordination of Palladium with Open-cage Fullerenes

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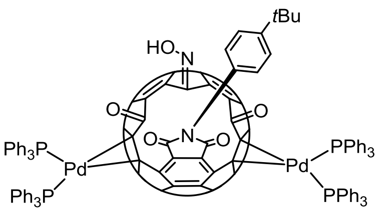
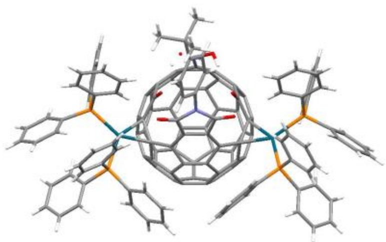
Numerous methods have been developed for the selective cleavage of C-C bonds to construct open-cage fullerene derivatives,[1] most of which employs oxidation with singlet oxygen or peroxides. As a result, various heteroatoms were installed on the rim of the orifice, which could serve as potential ligands for coordination to different metal ions. However, only limited examples of open-cage metal complexes have been reported due to much difficulty in the preparation of open-cage fullerenes.[2] Recently we found a new coordination pattern between open-cage fullerenes with Pd (0) in which two Pd can selectively bind to the C=C double bonds adjacent to carbonyl groups on the rim of orifice. Single crystal structures of Pd complexes were obtained.





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2. (a) C.-S. Chen, Y.-F. Lin, W.-Y. Yeh, *Chem. Eur. J.* **2014**, *20*, 936. (b) Aghabali, A.; Jun, S.; Olmstead, M. M.; Balch, A. L. *J. Am. Chem. Soc.* **2016**, *138*, 16459. (c) Z. S. Zhou, N. N. Xin, L. B. Gan, *Chem. Eur. J*. **2018**, *24*, 451.

Self-introduction

Name: Hao Zhang (张浩)

Hometown: Inner Mongolia

Education:

2010.9-2014.7 China Agricultural University,

2015.9-present Peking University. (with Professor Liangbing Gan)