# The Advanced Functional Materials Forum of CGCA

## Saturday 24th October 2020

## Berlin time: 14:00-16:00  Beijing time: 20:00-22:00

| Time | Action |
|---|---|
| **14:00-14:10** | **Introduction of CGCA**<br>***(Dr. Wenlan Liu)*** |
| **14:10-14:50** | **Application of polymer nanocomposites**<br>***(Prof. Dr. Guoxing Sun)*** |
| **14:50-15:30** | **Bio-inspired leaf-vein networks for high performance transparent conducting electrodes with high resource efficiency**<br>***(Dr. Guobin Jia)*** |
| **15:30-16:10** | **Atomically Precise Synthesis of Graphene Nanostructures with non-alternant topologies**<br>***(Prof. Dr. Junzhi Liu)*** |
| **16:10-16:20** | **Closing remark** |

*Detailed information about the speakers can be found in the Appendix (I biography; II abstract).*

## For more detail, please pay attention to our update!

# Appendix I. Biographies

***Dr. Guoxing Sun*** is an Assistant Professor of Macau University. He obtained his bachelor and master degree in Chemistry from Beijing Normal University in 2004 and 2009 respectively; and the PhD degree in civil engineering from the Hong Kong University of Science and Technology in 2015. His main research interest is organic/inorganic nanocomposite materials. He is managing 14 research projects (totaling 21.3 million RMB), leading a research group of 31 PhD students and postdoc fellows. He has published 55 SCI papers, with 38 as the first or corresponding author, such as "Nature Communications", "Materials Horizons" and "Journal of Materials Chemistry A". He has applied for 7 national invention patents (1 authorized), and 2 US invention patents (1 authorized). One invention patent has been transformed into a market product, and the current annual output value is about 160 million RMB. Another invention patent has entered the product pilot test stage, and cooperation intentions have been established with more than ten investment companies and customers.

***Dr. Guobin Jia*** studied Metal Physics at Lanzhou University (China) from 1990-1994, and obtained his PhD at Brandenburg University of Technology Cottbus-Senftenberg (Germany) in 2009, under the supervision of Prof. Martin Kittler in the field of Semiconductor Physics. He joined the Leibniz Institute of Photonic Technology in Jena in 2010. He has worked on different materials and devices for almost 30 years, ranging from metals, semiconductors, polymers, biomaterials, nanomaterials (including 1D, 2D) in the preparation, characterization and processing for the applications in energy harvesting and storage, light emitting diodes, sensing, quantum detection, photonics, smart textiles etc.

***Dr. Junzhi Liu*** received his Bachelor's degree in materials chemistry in 2008 and Master's degree in materials science in 2011. Then he joined the Max Planck Institute for Polymer Research in Prof. Klaus Müllen's group for PhD thesis, where he obtained his PhD degree in synthetic chemistry in January 2016. In July 2015, he joined Prof. Xinliang Feng's group as a postdoc in Technische Universität Dresden (TU Dresden). Since July 2017 he was a research group leader at the Chair for Molecular Functional Materials in TU Dresden. In August 2019, Dr. Liu started his group at the Department of Chemistry in The University of Hong Kong. His current scientific interests include bottom-up organic synthesis of topological carbon nanostructures and their applications for organic electronics. In the last 5 years, Dr. Liu has published more than 40 peer-reviewed papers in high-impact chemistry journals, including Science (1 paper), J. Am. Chem. Soc. (13 papers), Angew. Chem. Int. Ed. (7 papers), Adv. Mater. (1 paper), Chem. Sci. (1 paper), etc. Dr. Liu has been awarded several prizes such as "Marie-Curie" fellowship in 2011-2014, "Chinese Government Award for Outstanding Self-financed Students Abroad" in 2015, International Union of Pure and Applied Chemistry (IUPAC) International Award for Young Chemists - Honorable Mention Award (2017). Dr. Liu is an Early Career Advisory Board for Chemistry – An Asian Journal (2020-).

# Appendix II. Abstract

**Application Research of Polymer Nanocomposites (Guoxing Sun)**

The speaker will use two examples of industrialized technology inventions to describe how to effectively combine and apply the two different disciplines of chemistry and civil engineering to the research and development of various composite materials. (1) Use cement as raw material to produce nanoparticles (size <5 nm), and use them to prepare a series of hydrogels with super elasticity, adsorption and water swelling properties, and develop their applications in engineering, electronics, biological materials, environment and other fields. (2) Low-cost, nanoparticle-stabilized foam that can keep stable for years, which could be used to mix with cement paste to prepare lightweight, high-strength, fire-resistant and thermally insulated foam cement. The product was widely used in fabricated lightweight wall panels for energy-efficient buildings.

**Bio-inspired leaf-vein networks for high performance transparent conducting electrodes with high resource efficiency (Guobin Jia)**

Resource efficiency is an important issue in our modern society, since many of the severe problems such as short supply of critical resources & energy, environmental pollution, and climate change has close relation to it. Inspired by the excellent resource management and transport function of leaf veins, in this contribution we mimic the electrical current transport through metallized leaf vein networks produced by electroless copper plating. It is demonstrated that certain leaf veins can be converted to transparent conductive electrodes with ultralow sheet resistance 100 times lower than state-of-the-art ITO thin films, combined with broadband optical transmission above 80% in the UV-VIS-IR range. Additionally the resource efficiency of the vein-like electrode is characterized by low material needed to build up the networks and the low copper consumption for the metallization. Particularly, the high current density transport capability was demonstrated which can trigger high power density applications in optoelectronics, Li-ion batteries and supercapacitors.

**Atomically Precise Synthesis of Graphene Nanostructures with non-alternant topologies (Junzhi Liu)**

Defects have been observed in graphene and are expected to play a key role in the optical and electronic properties. Characterization of the atomic defects is important for fundamental understanding of material properties, due to the nature of the atomic bonding structure gives direct information regarding the bulk electronic and mechanical properties. However, the defects in graphene are still not well understood despite the growing number of experimental observations. For instance, the only experimentally realized the pentagon-heptagon pair or SW defects have been focused on the characterization of their structure in graphene, to evaluate and investigate the effect of geometrical defects on optical, electronic and magnetic properties are limited. Thus, the investigation of the chemical and physical properties depending on the defined defect play an important role in defect engineering of graphene, which can provide insight into understanding the structure-property relationships of graphene. In this abstract, I will introduce the synthesis of structurally well-defined defective nanographenes containing azulene units both in solution and on surface (Figure 1), to investigate the effect of geometrical defects on optical, electronic and magnetic properties. Our work offers insights for understanding and enables control of the electronic structure of expanded nanographenes and graphene at the atomic level.