CHINESE CHEMICAL SOCIETY

ROYAL SOCIETY OF CHEMISTRY

2021

CCS–RSC Young Chemists Summit

中国化学会–英国皇家化学会青年化学家峰会

15–16 December 2021

Book of Abstracts

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Welcome Addresses from the Chinese Chemical Society

Dear Dr Pain, Scholars, Delegates, and Friends,

As the 2021 CCS-RSC Young Chemists Summit opens today, I wish to extend, on behalf of the Chinese Chemical Society (CCS), a hearty welcome and warm greeting to all invited speakers and delegates attending this summit.

This year marks the 15th anniversary of the cooperation between the Chinese Chemical Society and the Royal Society of Chemistry (RSC). Over the years, the CCS and the RSC have carried out a series of fruitful work under the framework of the cooperation agreement, which has played an important and positive role in promoting the understanding and scientific research cooperation among chemists from China, the UK, and around the world. The leadership of the CCS and the RSC have consistently maintained friendly and smooth exchanges. Before the epidemic, leaders of the two sides arranged many mutual visits to persistently explore and deepen the cooperation. The CCS, the RSC, the CSJ (Chemical Society of Japan), and the GDCh (German Chemical Society) jointly hold the "Chemical Sciences and Society Summit," which is hosted in turn among the host countries to put forward chemical solutions for problems of common concern around the world and jointly define a roadmap of socially sustainable development through the wisdom of chemists. Since 2013, the CCS and the RSC have jointly established the *Inorganic Chemistry Frontiers* and *Organic Chemistry Frontiers* with Peking University and the Shanghai Institute of Organic Chemistry, Chinese Academy of Sciences. In 2017, the CCS, the RSC, and the Institute of Chemistry, Chinese Academy of Sciences have jointly officially published the third Frontiers series journal- *Materials Chemistry Frontiers*. The Frontiers series has rapidly risen to rank among the world's first-class journals.

In 2007, the two sides cooperated to establish the "CCS-RSC Young Chemist Award," for young chemists aged 40 and below with outstanding academic performance. This award has been given 7 times, and a total of 28 young chemists have been awarded. This award has achieved extensive influence and credibility among chemists in China. All the invited Chinese speakers and chairs of this summit are winners of this award. Thank you for all your support!

It is good to have this opportunity to express our sincere thanks to the RSC for its support to the CCS. We will soon usher in the year 2022, China's "tiger" year. We look forward to the early end of the pandemic, the resumption of offline mutual visits and activities between the two societies, and the continuous deepening of cooperation between the two societies to promote the exploration of more fields for feasible cooperation.

I wish the summit is a complete success. Thank you！

Prof. Weihong Tan
Vice President,

Chinese Chemical Society

Welcome Address from the Royal Society of Chemistry

Dear Colleagues and Friends,

For the past 15 years, we have worked with CCS to advance the chemical sciences in China and abroad, and to strengthen scientific links between our two countries.

We have achieved a great deal together, including establishing the CCS-RSC Young Chemists Award, and launching our joint Frontiers journal portfolio.

We were delighted to renew our formal cooperation agreement with the CCS earlier this year. China is a global leader in the chemical sciences and the CCS is one of the RSC's most valued collaborators.

This event is a chance to celebrate our long-term partnership with the Chinese Chemical Society and to recognise and celebrate exceptional chemical scientists through our prizes and awards programme. At this Summit, we honour eight of our recent winners from China and around the world – four recipients of the CCS-RSC Young Chemist Award, and four winners of an RSC Lectureship Award. I would like to congratulate our winners and thank them for joining us to share their research. We are proud to have this opportunity to showcase the work of these emerging leaders in our discipline.

We look forward to working together even more closely in the future, for the benefit of chemical scientists in China and the UK, and of global science.

Dr Helen Pain CSci CChem FRSC
Chief Executive

Royal Society of Chemistry

CCS-RSC Young Chemists Summit 2021

Programme Agenda

15 December 2021

(China Time)

Time	Speakers	Chairs
16:00-16:10	Introduction and welcome	
16:10–16:40	**Adhesive hydrogels for biomedical applications** Nasim Annabi, *University of California, United States*	Shu-Li You, *Shanghai Institute of Organic Chemistry, CAS, China*
16:40–17:10	**Efficient and scalable organic synthesis to facilitate chemical biology research** Tuoping Luo, *Peking University, China*	
17:10–17:40	**Strategies for efficient inverted architecture perovskite solar cells** Yana Vaynzof, *Technical University of Dresden, Germany*	
17:40 – 18:10	**Biomaterials to boost cancer immunotherapy** Zhuang Liu, *Soochow University, China*	
18:10	Closing remarks	

CHINESE CHEMICAL SOCIETY ROYAL SOCIETY OF CHEMISTRY

CCS-RSC Young Chemists Summit 2021

Programme Agenda

16 December 2021

(China Time)

Time	Item	Session chair
16:00-16:30	**A new approach to precise synthesis of heterogeneous catalyst: atomic layer deposition** Junling Lu, *University of Science and Technology of China, China*	Xun Wang, *Tsinghua University, China*
16:30-17:00	**Recent development in shuttle catalysis** Bill Morandi, *Swiss Federal Institute of Technology in Zurich, Switzerland*	
17:00-17:30	**Materials strain for catalysis** Shaojun Guo, *Peking University, China*	
17:30-18:00	**Catalytic carbonyl-Olefin metathesis and oxygen atom transfer** Corinna Schindler, *University of Michigan, United States*	
18:00	Closing remarks	

Biographies notes of Speakers and Speech Abstracts

Nasim Annabi
University of California, United States

Nasim Annabi is an Assistant Professor in the Department of Chemical and Biomolecular Engineering at University of California, Los Angeles (UCLA). She received a PhD in Chemical Engineering from the University of Sydney (Australia). From 2011-2014, she was a postdoctoral fellow at Harvard Medical School and the Wyss Institute for Biologically Inspired Engineering. Before joining UCLA in 2018, she was an Assistant Professor in the Department of Chemical Engineering at Northeastern University. Dr. Annabi's group has expertise in the design and engineering of advanced biomaterials for applications in regenerative medicine. In addition, her research team has devised innovative strategies for the development of advanced bioadhesives and surgical sealants with high clinical translation for surgical applications. Dr. Annabi has published over 140 articles in peer-reviewed journals. She has been cited over 14,628 times and her H index is already at 61. Her innovations have resulted in 15 patents and generated significant commercial interest. Dr Annabi has been recognized with several national and international awards including the 2021 Young Investigator Award from the Society for Biomaterials (SFB), the 2021 Biomaterials Science Lectureship Award from the Royal Society of Chemistry (RSC), the 2020 Nanoscale Science and Engineering Forum (NSEF) Young Investigator Award of American Institute of Chemical Engineers (AIChE), the Australian Prestigious Endeavour Award, and the National Health and Medical Research Council Early Career Award. Her team has received major grants from the National Institutes of Health (NIH), the Department of Defense (DOD) and the American Heart Association (AHA).

Adhesive hydrogels for biomedical applications

Nasim Annabi

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Abstract:

Tissue engineering is an interdisciplinary field incorporating concepts from engineering, biological sciences, and medicine with the goal of engineering biological substitutes to maintain, restore and promote normal tissue function. Polymer-based biomaterials have played an important role in the development of tissue constructs that mimic the structures and physical properties of the native tissues. However, there are still many challenges in micro-engineering biomaterials with tunable physical and biological properties for the development of fully functional tissue constructs. The combination of advanced biomaterials with micro- and nanoscale technologies have been shown to hold great potential to address the current challenges in tissue engineering. Our research focuses on developing biomimetic elastin-based biomaterials and nanocomposite hydrogels, with controlled architecture, and physical and biological properties, utilizing recombinant proteins. These advanced biomaterials are integrated with different micro- and nano-fabrication technologies to engineer biomimetic tissue constructs for engineering soft and elastic tissues. Furthermore, we have developed new chemistries to improve the adhesion of these biomaterials to the tissue surfaces and use them as multi-functional bioadhesives for sealing and repair of soft tissues such lung, heart, skin, and cornnea. In addition, our group has designed different nano delivery planforms which can be incorporated in these bioadhesives for gene and drug delivery applications. In this presentation, I will outline our recent work on the development of adhesive and elastic hydrogels for tissue engineering along with their clinical applications as tissue adhesives and surgical sealants.

Tuoping Luo (罗佗平)
Peking University, China

Tuoping Luo was born on 1982 in Fujian, China. He won a Gold Medal in the 33rd International Chemistry Olympiad (IChO, 2001) during high school. From 2001 to 2005, he studied chemistry at Peking University and performed undergraduate research in Prof. Zhen Yang and Prof. Jiahua Chen's group. In 2011, He received his Ph.D. degree with Prof. Stuart L. Schreiber at Harvard University and Broad Institute. He did his post-doctorate research under the supervision of Dr. John Yuan Wang in H3 Biomedicine Inc., a start-up company focusing on oncology drug development. He returned to Peking University in 2013 and started his independent group, and joined the Peking-Tsinghua Center for Life Sciences. His group concentrates on the investigation and development of biologically active small molecules.

Efficient and scalable organic synthesis to facilitate chemical biology research

Tuoping Luo (罗佗平)

Peking University, China

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Abstract:

Small-molecule natural products are favorable starting points for the development of not only medicines but also useful probes or tool compounds to specifically modulate target proteins. However, their scarcity in nature, difficulties in isolation/purification, unidentified mechanism-of-action and complicated structures present significant challenges for further investigations, whereas the organic synthesis has proven to be not only a powerful and irreplaceable technology for corresponding chemical biology studies, but also a driving force for advancing and applying novel synthetic methodologies. Focusing on the investigation of small molecules with important biological activities, our group have recently developed new synthetic strategies to efficiently access diterpenoids and steroids with high oxidation levels, including (-)-vingirol, (-)-oridonin, (+)-wortmannin, and (–)-batrachotoxin. These form the basis for us to further investigate the mechanism-of-action of small molecules and corresponding activity profiles, laying down the foundation for target identification and validation in drug discovery, as well as realizing precise control in chemical biology.

Yana Vaynzof
Technical University of Dresden, Germany

Prof. Dr. Yana Vaynzof is the Chair for Emerging Electronic Technologies at the Technical University of Dresden (Germany). She received a B.Sc. in Electrical Engineering from the Technion – Israel Institute of Technology (Israel) in 2006 and a M. Sc. In Electrical Engineering from Princeton University (USA) in 2008. In 2011, she received a Ph.D. in Physics from the University of Cambridge (UK). Prior to commencing her current position in 2019, Yana was a postdoctoral research associate at the Cavendish Laboratory, University of Cambridge (UK) and an assistant professor at Heidelberg University (Germany). Yana Vaynzof is the recipient of a number of fellowships and awards, including the ERC Starting Grant, Gordon Wu Fellowship, Henry Kressel Fellowship, Fulbright-Cottrell Award and the Walter Kalkhof-Rose Memorial Prize. Her research interests lie in the field of emerging photovoltaics focusing on the study of material and device physics of organic, quantum dot and perovskite solar cells.

Strategies for efficient inverted architecture perovskite solar cells

Yana Vaynzof

Technical University of Dresden, Germany

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Abstract:

In recent years, remarkable progress has been made in the field of solution-processed perovskite solar cells, resulting in power conversion efficiencies (PCE) of >25%. These high efficiencies are demonstrated for devices in a standard architecture, in which a perovskite layer is deposited on top of an electron transport layer (ETL) and capped with a hole transport layer (HTL). Despite significant interest in the development of inverted architecture solar cells, in which the order of extraction layers is reversed, their efficiency remains below that of devices made in the standard structure. In this talk, I will introduce three strategies for the fabrication of efficient perovskite solar cells in an inverted architecture. First, I will describe how controlling the rate of antisolvent deposition allows for the fabrication of efficient perovskite solar cells from any antisolvent.[1] Next, I will show that changing the antisolvent deposition method increases the device performance by better preserving the intended perovskite stoichiometry.[2] Finally, I will present a novel dual modification approach that simultaneously increases all the device photovoltaic parameters, leading to a maximum power conversion efficiency of 23.7%.[3]

[1] "A General Approach to High Efficiency Perovskite Solar Cells by Any Antisolvent", A. D Taylor, Q. Sun, K. P. Goetz, Q. An, T. Schramm, Y. Hofstetter, M. Litterst, F. Paulus, Y. Vaynzof, Nature Communications, 12, 1878 (2021).

[2] "Preserving the Stoichiometry of Triple-Cation Perovskites by Carrier-Gas-Free Antisolvent Spraying", O. Telschow, M. Albaladejo-Siguan, L. Merten, A. D. Taylor, K. P. Goetz, T. Schramm, O. V. Konovalov, M. Jankowski, A. Hinderhofer, F. Paulus, F. Schreiber and Y. Vaynzof, submitted.

[3] 23.7% Efficient Inverted Perovskite Solar Cells by Dual Interfacial Modification, M. Degani, Q. An, M. Albaladejo-Siguan, Y. J. Hofstetter, C. Cho, F. Paulus, G. Grancini and Y. Vaynzof, Science Advances, eabj7930 (2021).

Zhuang Liu (刘庄)
Soochow University, China

Dr. Zhuang Liu is a professor at Soochow University in China. He received his BS degree from Peking University in 2004 and PhD degree from Stanford University in 2008. In 2009, Dr. Liu joined Institute Functional Nano & Soft Materials (FUNSOM) at Soochow University. Dr. Liu is now working in the field of biomaterials and nanomedicine, to develop smart materials and nanotechnology for biomedical imaging and cancer therapy. Dr. Liu has authored over 300 peer-reviewed papers, with a total citation of > 65,000 times and an H-index at 135. He has been listed as one of 'Highly Cited Researchers' (Materials, Chemistry) by Thomson Reuters since 2015. He was invited to be the Fellow of the Royal Society of Chemistry (FRSC) in 2015, and elected to be the Fellow of the American Institute for Medical and Biological Engineering (AIMBE) in 2019. The awards he received include the Xplorer Prize, Biomaterials Science Lectureship by RSC, National Distinguished Young Scholar Award (Fund) by NSFC, etc. Now he is serving as an associate editor for Biomaterials.

Biomaterials to boost cancer immunotherapy

Zhuang Liu (刘庄)

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Abstract:

Cancer immunotherapy has attracted tremendous attention in recent years. In our recent studies, by employing rationally designed biomaterials as well as nanoscale delivery systems, we are able to enhance cancer immunotherapy via developing novel nano-vaccines, modulating tumor microenvironment, and achieving combinational immunotherapy, as evidenced by various animal model experiments. In this presentation, I would introduce our latest efforts in this exciting research direction. In particular, we have tried to combine various types of local tumor treatment methods with immunotherapy using biomaterials as the bridge. Stimulated by the tumor-associated antigens released after local tumor ablation, the triggered immunological responses if in combination with immune checkpoint blockade (ICB) therapy could result in effective inhibition of tumor cells remaining in the body, promising for treatment of cancer metastasis. A strong immune-memory effect could also be observed after such treatment. A start-up company has been founded based on this technology, which hopefully will be tested in the clinic very soon.

Junling Lu (路军岭)

University of Science and Technology of China, China

Prof. Junling Lu received his PhD degree from Institute of Physics, Chinese Academy of Sciences under the supervision of Prof. Hongjun Gao in 2007. During his PhD studies, he visited Prof. Hans-Joachim Freund group at Chemical Physics Department, Fritz-Haber-Institute, Max Planck Society as an exchange student in 2004–2006. After graduation, he spent three years in Prof. Peter C Stair's group at Northwestern University and then about two and a half years in Dr. Jeffrey W. Elam's group at Argonne National Laboratory as a Postdoc. In March. 2013, he became a professor at University of Science and Technology of China. His current research interest is atomically-precise design of new catalytic materials using a combined wet-chemistry and ALD approach for advanced catalysis.

A new approach to precise synthesis of heterogeneous catalyst: atomic layer deposition

Junling Lu (路军岭)

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Abstract:

Heterogeneous catalysts synthesized by conventional wet-chemistry methods, including wet-impregnation, ion exchange, and deposition-precipitation often have very complex structures along with poor uniformity of active sites. Such heterogeneity of active site structures significantly decreases catalytic performance, and hinders atomic-level understanding of structure-activity relationships. Atomic layer deposition (ALD), has emerged as an alternative method to synthesize heterogeneous catalysts from gas-phase. It relies on a sequence of molecular-level, self-limiting surface reactions between the vapors of precursor molecules and a substrate. This unique character makes it possible to deposit various catalytic materials uniformly on a high-surface-area support with nearly atomic precision, thereby providing new opportunities for bottom-up construction of catalytic architectures on a support with near atomic precision. In this talk, I will discuss about synthesis of metal single atoms, dimers, trimers, bimetallic nanoparticles from the bottom up. Nanoscale metal-oxide interface engineering will be also described in the end.

Bill Morandi
Swiss Federal Institute of Technology in Zurich, Switzerland

Professor Bill Morandi studied at ETH Zürich (2003–2008), receiving a BSc in Biology and a MSc in Chemical Biology. From 2008 to 2012, he pursued his PhD in organic synthesis at the same institution in the labs of Professor Erick M. Carreira. Afterwards, he moved to the California Institute of Technology (Pasadena, CA) for a postdoctoral stay with Professor Robert H. Grubbs. From 2014 to 2018, he was an independent Max Planck Research Group Leader at the Max-Planck-Institut für Kohlenforschung (Mülheim, Germany), before subsequently returning to ETH Zürich as a Professor in 2018.

His research program targets the design and development of new catalytic reactions for the synthesis of small molecules and materials, as well as the valorization of renewable feedstocks and waste material. He has received numerous awards, among them a Novartis Early Career Award in Organic Chemistry, the Carl Duisberg Memorial Prize from the German Chemical Society and a selection as a C&EN's Talented 12.

Recent developments in shuttle catalysis

Bill Morandin

Swiss Federal Institute of Technology in Zurich, Switzerland

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Abstract:

In this talk, a series of newly developed shuttle and metathesis reactions will be discussed. This includes for example the concept of e-shuttle for reversible halogenation as well as new functional group metathesis reactions. Interdisciplinary applications of these reactions to the recycling of persistent organic pollutants and synthesis of recyclable porous polymers will also be discussed.

Shaojun Guo (郭少军)
Peking University, China

Shaojun GUO is a Boya Distinguished Professor in the School of Materials Science and Engineering, Peking University, and a Fellow of the Royal Society of Chemistry. He is renowned for his leadership in nano/sub-nano/atomic materials for catalysis and energy applications. He has made outstanding contribution to the interdisciplinary fields of materials chemistry for energy electrocatalysis. He has published more than 200 papers in top journals as corresponding author, including 22 in Nature, Science and Nature/Science/Cell sister journals (h-index=118 and 49,000 citations). He is one of Highly Cited Researchers from 2014 to 2021, and World Top 2% Scientist (Stanford University). He has been honored with numerous awards, including Xplorer Prize, National Science Fund for Distinguished Young Scholars, China Youth Science and Technology Prize, etc. He is serving as more than ten (advisory) board members of *Chem. Commun.*, *Sci. Bull.*, *Sci. China Mater.*, *eScience*, *etc*.

Materials strain for catalysis

Shaojun Guo

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Abstract:

Green hydrogen energy is a promising pathway to reduce social dependence on fossil fuels. How to develop new strategies for improving the catalytic efficiency for hydrogen generation and usage is the key in achieving high-performance fuel cells. Tuning or controlling the surface strain in multimetallic nanomaterials is a robust method to boost electrocatalytic performance, and tremendous progress has been made in this area in the past decade. In this talk, I will show our recent important advances in how to tune the surface strain in multimetallic nanocrystals to achieve more efficient electrocatalysis for hydrogen cycle.

Corinna Schindler
University of Michigan, United States

Corinna was born and raised in Schwäbisch Hall, Germany. As an undergraduate at the Technical University of Munich, she worked in the area of organometallic chemistry. Upon completion of her Diploma Thesis at the Scripps Research Institute in La Jolla in the laboratory of K.C. Nicolaou, she joined the research group of Erick M. Carreira at the ETH Zurich in Switzerland for her graduate studies. During her time in the Carreira group Corinna worked on developing novel synthetic methodologies as well as successful synthetic strategies to access Banyaside B and Microcin SF608. For her postdoctoral studies, Corinna joined the laboratory of Eric N. Jacobsen at Harvard University as a Feodor Lynen Postdoctoral Fellow to work in the field of asymmetric catalysis.

She started her independent career at the University of Michigan in the Fall of 2013, was promoted to Associate Professor in 2019 and to Full Professor in 2021.

Catalytic carbonyl-olefin metathesis and oxygen atom transfer

Corinna Schindler

University of Michigan, United States

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Abstract:

The olefin-olefin metathesis reaction is a revolutionary industrial process that utilizes precious metal complexes to enable direct carbon-carbon bond formation from simple olefin starting materials. The carbonyl-olefin metathesis reaction similarly enables the construction of carbon-carbon bonds and has the potential to have an analogous impact on synthetic strategy. However, currently available synthetic procedures are significantly less advanced. My research laboratory has developed a Lewis acid-catalyzed carbonyl-olefin metathesis that represents a new reactivity mode between carbonyl and olefin functionalities. Our design principle fundamentally differs from stoichiometric carbonyl-olefin metathesis protocols proceeding via intermediate oxametallacycles. It is instead based on the *in situ* formation of oxetanes as reactive intermediates via an asynchronous, concerted [2+2]-cycloaddition of a carbonyl and an olefin upon activation with $FeCl_3$ as Lewis acid catalyst. This distinct reactive intermediate no longer limits the process to precious metals, enables catalytic turnover, and prevents the formation of stoichiometric waste. A first report of our work was published in Nature and we have since been able to demonstrate the generality of our approach in the synthesis of a variety of challenging structural motifs. We have since been able to develop a fourth reactivity mode between carbonyls and olefins that proceeds under Brønsted acid catalysis but also relies on oxetanes as reactive intermediates. Under protic conditions oxetanes undergo distinct fragmentation via oxygen-atom-transfer from the carbonyl to the olefin component to result in the formation of carbocation intermediates. This enables a new strategy for facile carbon-carbon bond formation between two ubiquitous functional groups, carbonyls and olefins.

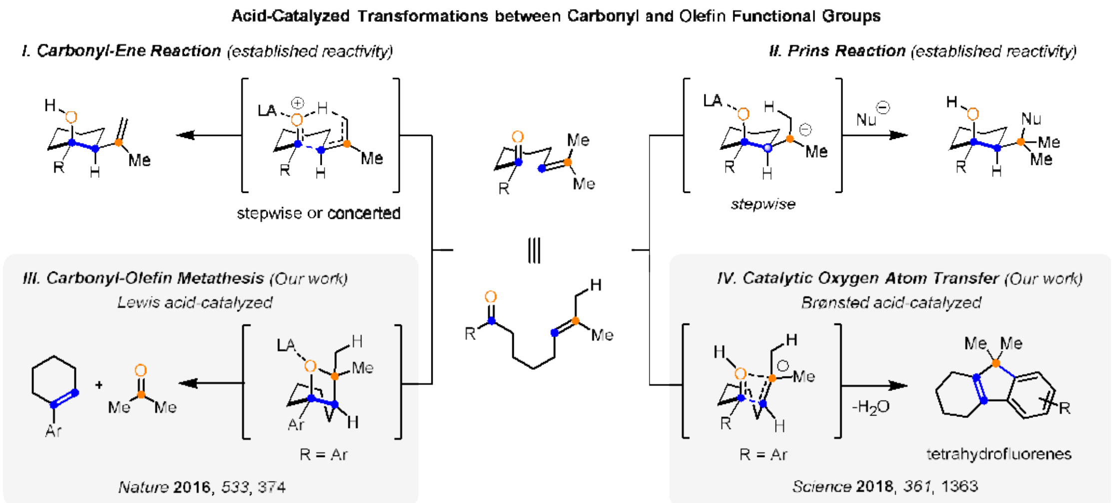

Figure. Established reactivity between carbonyl and olefin functionalities and new reactivity developed in our research program.

Biographies Notes of Moderators

Shu-Li You (游书力)
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Shu-Li You, Professor, State Key Laboratory of Organometallic Chemistry, Shanghai Institute of Organic Chemistry, Chinese Academy of Sciences. His research interests mainly focus on asymmetric C-H functionalization and catalytic asymmetric dearomatization (CADA) reactions. Prof. You and colleagues have developed efficient synthesis of compounds bearing planar, axial, or helical chirality by asymmetric C-H functionalization processes. In addition, various asymmetric dearomatization reactions have been realized by starting from the abundant and readily available arenes, providing direct access to polycylces and spirocycles bearing quaternary stereogenic center.

Xun Wang (王训)
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Prof. Xun Wang is working in the field of synthesis and applications of inorganic nanocrystals. Prof. Wang and his colleagues established a general good-poor solvent synthetic methodology of sub-1nm nanomaterials. Based on the successful synthesis of sub-1nm inorganic nanowires, he proposed the concept of sub-1 nm materials, and found that quasi-1D inorganic materials will possess macromolecule-like properties when their sizes and dimensions are carefully controlled within ultrathin region, which may bridge inorganic and polymer-based materials. Prof. Wang and his colleagues realized the controlled assembly of atomic-precision clusters and their co-assembly with inorganic nuclei, which enabled the tailoring of compositions of inorganic materials in sub-1nm scale.