Academic Consortium 21

AC21 Newsletter

November 2022, Volume 31

Contents

11th AC21 International Forum 2022

"International Higher Education for a Sustainable Society" December 7 - 9, 2022

Warmest greetings from Nagoya University. We are pleased to welcome the members of AC21 to our HigasWarmest greetings from Nagoya University. We are pleased to welcome the members of AC21 to our Higashiyama Campus for the 11th AC21 International Forum on December 7-9, 2022.

The objective of this Forum is twofold. First, this event will provide the participanwith an opportunity to come together and discuss the role of international higher education in a global society. The outbreak of the pandemic has forced higher institutions to accelerate towards exploring new approaches to international and interdisciplinary collaborations. The Forum will investigate this crucial topic through keynote lectures, panel sessions and a student session.

Second, this Forum will serve as a venue to look back upon and into a future beyond the AC21 network. As we have announced, in addition to marking its 20th anniversary, our consortium will come to a close at the end of 2022. Therefore, we will take this opportunity not only to celebrate our achievements over the past 20 years but also to discuss ways to sustain and further develop this crucial academic network.

On this occasion, Nagoya University would like to express our sincerest appreciation to all the AC21 members for their significant contributions for over the years. While the prolonged travel restrictions have made it difficult for several delegates to attend the Forum in person, we are looking forward to welcoming those who are able to join us here at Nagoya University, and to seeing all the members at the Student Session and General Assembly Meeting that will be held in hybrid format.

Special Project Fund <Report 1>

“Pre-clinical development of antimicrobial peptides”

Prof. Burkhard Bechinger
Membrane Biophysics and NMR Chemistry Institute UMR 7177,
University of Strasbourg

Partners at four AC21 member institutions in four countries came together to continue, revive and start new collaborations on antimicrobial peptides. Successful pre-existing bilateral collaborations between some members include the Universities of Minnesota and Strasbourg and between the French team and the group at Stellenbosch. Based on these successful, but geographically limited, interactions, as well as to overcome the restrictions imposed by the covid 19 pandemic, the workshop was initiated. The aim was to further increase collaboration and to enlarge the network of collaborators.

The workshop was broadly advertised at the member institutions, through the AC21 website, antibiotic newsletters, the French network on antimicrobial peptides (MuFoPam) and by direct email and social media campaigns in early 2022. Thus, additional students and scientists from afar participated at the meeting, indicating that the network can be extended by other Institutions making available additional techniques.

The excellent response reflects the need of such a meeting and the successful choice of such a research topic. Notably, the participation of many students and post-docs assures that the collaborations will include and continue with the next generation of scientists.

During the workshop 15 talks were presented including PhD students, junior and established scientists (cf. program) which allowed a comprehensive view of the ongoing research in different departments of the four AC21 member institutions. Talks were broadly dedicated to

I : Biomaterials based on Coatings with Antimicrobial Peptides,

II : The Mechanisms of Action of Antimicrobial Peptides in Different Environments,

III : New Strategies to use Antimicrobial Peptides

IV : Biophysical Techniques to Prepare and Investigate Antimicrobial Peptides and Biomaterials.

The program also included several sessions that allowed for the exchange and discussion around 17 posters which were presented by students and senior scientists.

Eighty participants, including many students and junior scientists, registered and participated actively at the workshop, eight of them from overseas institutions. For the first time the data, expertise and instrumental capacities of the participating research teams were presented in a comprehensive manner and links between different teams and research subjects were established. By allowing this global view, the program turned out highly interesting. The newly established contacts lead to a great number of planned collaborations that promise to extend well beyond this initial stimulus and detailed plans for scientific exchange have already been submitted for 2023 and 2024. Importantly, already during the period of the Special Project Fund first NMR experiments on antimicrobial peptides produced in South Africa were performed in the French laboratory. Thereby the AC21 funding has allowed us to go well beyond this two-day workshop.

The feed-back was extremely positive and enthusiasm was pronounced thus plans were already made for another edition of the meeting.

Special Project Fund <Report 2>

"Fostering collaborations in Antarctic tourism research"

Dr. Yu-Fai Leung
Professor and Director of Graduate Programs
Department of Parks, Recreation and Tourism Management
North Carolina State University

Project Background

Antarctica, the last frontier on earth, is witnessing drastic changes in recent decades due to a variety of global and regional forces such as climate change, fisheries, introduced species, and increasing human activities. Tourism, the biggest human activity in the continent, which has been steadily increasing and quickly diversifying in terms of tour itineraries and characteristics. Limited research has been devoted to Antarctic tourism, including ecological effects, tourist experiences, sustainable management, and governance and policies. However, this body of research is highly fragmented (Stewart et al., 2017). There remains wide knowledge gaps on many fronts of Antarctic tourism as research efforts are not commensurate with the pace of changes.

The AC21 Special Project Fund provided a unique and timely opportunity to examine the state of research on Antarctica tourism and key research priorities through the AC21 partner institutions and non-AC21 collaborators. The overall goal of this project was therefore to build a community of researchers who collaborate to tackle high-priority knowledge gaps that inform sustainable management of Antarctic tourism. Specific objectives were:

1) TO build a collaborative research network on Antarctic tourism;

2) TO facilitate short-term collaborations, and

3) TO develop a proposed research agenda with community participation through a workshop and online exchange.

Activity Highlights

During the implementation of the project, a total of 12 meetings were conducted with the active collaboration of 11 polar research experts representing eight academic institutions from eight countries, including Australia, China, Ecuador, the Netherlands, New Zealand, Spain, the United Kingdom, and the United States. Members of this project made multiple oral presentations in two international conferences, presenting results of short-term collaborations and a participatory Horizon Scan process for developing an Antarctic tourism research agenda. Two major events are an online panel session in the 2021 SC-HASS Biennial Conference organized by this project team, and a hybrid AC21 Workshop held in Potsdam, Germany in May 2022, with participation of the project members and colleagues from a larger research community.

From an academic perspective, the collaborations of this project results in two peer-reviewed articles, with one more article in press and several additional manuscripts in progress. Two online surveys were conducted as part of the Horizon Scan process for developing an Antarctic research agenda for tourism. Over 80 responses were obtained for each of these surveys with participation from 19 different countries. The finalized research agenda will be widely disseminated through academic and Antarctic governance outlets.

Achievement Highlights

Building upon three AC21 partner institutions, NC State, Canterbury, and Tongji, this project brought together an 11-member core team, some of whom had not collaborated prior to the project. The project has contributed to the formation of the Antarctic Tourism Action Group (Ant-TAG) under the Scientific Committee on Antarctic Research (SCAR), through which the core team and other collaborators full expect to continue and expand our collaborations beyond this project's completion.

Another major achievement of this project is a community-based research agenda for Antarctic tourism through a participatory process, involving both the core project team and a broader community with expertise on tourism research in Antarctica and other protected areas. We believe that this research agenda will catalyze the discourse on Antarctic tourism, stimulate collaborative research in the near future, and inform priorities of funding programs in the industry and scientific organizations.

Conclusion

We have achieved our project objectives and made significant advancements toward the ultimate goal. We have contributed to research on Antarctic tourism through our presentations and publications, and to the Antarctic tourism community by developing a community-based research agenda for the next 3-5 years. We believe that Antarctic and broader polar issues will continue to evolve and research collaborations are much needed to inform policy and management decisions. Global academic networks like the AC21 are well positioned to foster academic collaborations and stakeholder engagement in a joint effort to conserve and sustain these global commons.

The project team is most grateful for the financial support from the Academic Consortium 21 and their gracious extensions of project timelines.

Special Project Fund <Report 3>

“Narrow bandgap photocatalysts for high-efficiency renewable hydrogen production.

Prof. Gregory F. Metha
Department of Chemistry, The University of Adelaide

This AC21-funded project sought to combine the strengths of three Chemists from three different continents to solve one of the most wicked problems facing society – climate change. The widespread use of green hydrogen as a replacement fuel is regarded as essential to cease further emissions of dangerous greenhouses gases caused by combustion of fossil fuels.

Green hydrogen is produced from water but requires large amounts of electricity which must be generated from renewable sources (e.g. solar or wind). Unfortunately, the cost is several times higher than hydrogen produced from fossil fuels such as natural gas (grey hydrogen). However, it is possible to produce hydrogen directly from water and sunlight using a process called photocatalysis.

An efficient photocatalyst material requires three key components: (i) a semiconductor that can absorb as much solar energy as possible (i.e. has a small bandgap) and convert the solar photons into negative and positive charges (electrons and holes, respectively), (ii) possess an electronic structure that enables these charges to effectively migrate to the surface without recombining, and (iii) have suitable surface co-catalysts that facilitate the chemical conversions necessary to produce hydrogen (H2) and oxygen (O2) gas from water (H2O). Photocatalysts that can do all these processes with nearly 100% efficient are known but they only work with the high energy (ultraviolet) part of the solar spectrum.

This is where the three chemists come in. Prof Paul Maggard (North Carolina State University) specializes in making metastable semiconductors with optimal electronic structures called perovskites. A/Prof Vladimir Golovko (University of Canterbury) is an expert in metal clusters which are ideal as surface co-catalysts. Prof Greg Metha (University of Adelaide) is a physical chemist who builds and tests reactors for photocatalysis. Together with PhD students (see Figure 1) Sean O'Donnell (NCSU), Shalendra Sharma (UC), Tom Small (UoA) and Hanieh Mousavi (UoA), the team embarked on an ambitious program project to develop the ideal water-splitting photocatalyst.

Following careful planning over Zoom meetings, various formulations of the perovskite SnxBa1-xZr0.5Ti0.5O3 (called tin substituted BZT or Sn-BZT) were prepared in the USA, and the gold clusters Au9 and Au101 were synthesized in New Zealand. These samples were sent to Australia for assembly using an environment-controlled furnace (purchased with project funds, Figure 2) and subsequent photocatalyst testing. The perovskite Sn-BZT material was found to have a core-shell structure (Figure 3) with increased visible light absorption capability (the band-gap was reduced from 3.4 to 2.2 eV). Importantly, X-ray diffraction showed that the overall material maintained excellent crystallinity, which is necessary for conducting the charge carriers. Using high resolution electron microscopy, the gold cluster clusters were shown to have a very narrow size distribution, which is important for efficient charge separation.

Upon combining, the clusters did not decorate the BSZT surface as expected, and furthermore there was little or no photocatalytic activity. Using the unusual technique of Mössbauer spectroscopy (with samples sent to Germany), it was found that the Sn-BZT has a thin layer of tin oxide (SnO2) which likely impedes charge migration to the surface. Using a different perovskite (Al:SrTiO3), the Au101 clusters were added with reduced graphene oxide (rGO), which acted as a conducting electron bridge. These samples dramatically outperformed all the control samples in photocatalytic testing, indicating that this was a successful strategy readily applicable to a visible light active photocatalyst such as Sn-BZT.

Even though the desired outcome was not reached over the duration of the project, significant advances were made in understanding these promising materials as evidenced by two published papers based on this work:

1. S. O'Donnell et al., Prediction and Kinetic Stabilization of Sn(II)-Perovskite Oxide Nanoshells, Chemistry of Materials, 34, 8054-8064 (2022).

2. H. Mousavi et al., Graphene bridge for photocatalytic hydrogen evolution with gold nanocluster co-catalysts, Nanomaterials, 12, 3638 (2022).

More importantly, the three Chemists have agreed to continue collaborating to advance the development of photocatalysts to produce cheap and abundant green hydrogen, which would not have happened without the generous support of AC21 to germinate the project.

Figures

Figure 1. PhD students Sean O'Donnell (NCSU), Shalendra Sharma (UC), Tom Small (UoA), and Hanieh Mousavi (UoA).

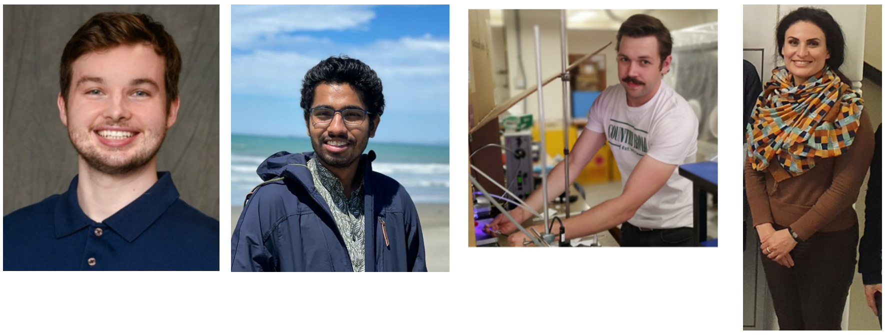
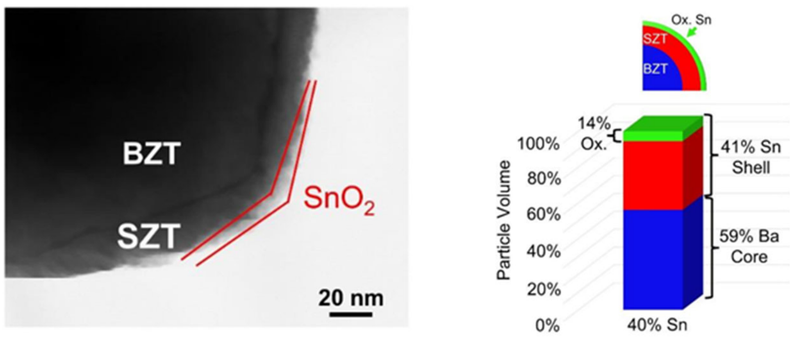


Figure 2. Environment controlled furnace used for the final preparatory step to synthesize the photocatalysts

Figure 3. High resolution electron microscopy image of BSZT showing the three domains (left). Calculated fractions of the three domains (right).



AC21 General Secretariat Activities (April 2022 - November 2022)

YEAR	DATES	EVENT/ACTIVITY
2022	January	Evaluation for SPF2022
	February	Announcement for the result of SPF2022
	April 20	AC21 Steering Committee Meeting (STC)
	September 7	AC21 Steering Committee Meeting (STC)

Upcoming AC21 Activities and Events

YEAR	DATES	EVENT/ACTIVITY	HOST
2022	December 7-9	11th AC21 International Forum	Nagoya University (Japan)
	December 7	20th AC21 Steering Committee Meeting (STC)	AC21 General Secretariat
	December 8	11th AC21 General Assembly Meeting (GA)	AC21 General Secretariat
2023	March 1	Due date of SPF2022 Final Reports	
	March 31	Closing AC21 General Secretariat	

Members

AC21 General Secretariat
NAGOYA UNIVERSITY
464-8601 Furo-cho, Chikusa-ku, Nagoya, Japan
E-mail: office@ac21.org

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