

SynCat's Dr Tingbin Lim explains an experimental setup to visitors (photo Ajin Cheruvathur)

The SynCat@Beijing Laboratory:

Collaboration with industry is key to the advancement of clean fuel technology

SynCat@Beijing is the Synfuels China Laboratory for Fundamental Research, a young internationally oriented team dedicated to improving the economics of clean Coal-to-Liquids technology and coal's carbon footprint. As researchers and the public across the globe become more aware of the environmental impact of fossil fuels, the SynCat@Beijing laboratory's work becomes increasingly relevant. Research Director Hans Niemantsverdriet is here to tell us more about what goes on in the lab.

Although it is likely that in the future all energy will be derived from sustainable sources, until then, and during the transition phase, the world will have to continue to rely on fossil fuels. At SynCat@Beijing, the Synfuels China Laboratory for Fundamental Research, Research Director Hans Niemantsverdriet knows that clean Coal-to-Liquids technology is preferable to direct combustion of coal, as toxic impurities can be removed in the process before use.

In this interview, Professor Niemantsverdriet told *Research Features* more about the background and importance of the laboratory's research, the scientific community in China and why

he thinks education and collaboration are key to successful and productive research.

Hi Hans! Can you tell us more about SynCat@Beijing in terms of its background, history and core mission/vision?

SynCat@Beijing is a privately-owned laboratory for fundamental research into the field of clean synthetic fuel derivatives from coal. It belongs to Synfuels China Technology Co, Ltd in Beijing-Huairou. The laboratory has internationally oriented staff, though the majority are Chinese, but all have foreign research experience.

The aim is to build a centre of expertise on the fundamentals behind the core-

business of the parent company, notably on surface science, model catalysis and photo-/electro-chemistry. Such knowledge is an important background for understanding the industrial processes which convert dirty coal into clean, high-quality fuels. The centre should serve as a platform for joint in-house and collaborative international projects.

China has hardly any other alternative to coal as their main energy source. It is therefore of the utmost importance that it is used in a responsible way. In this sense converting coal to synthesis gas, thereby removing all pollutants, and then reacting it to clean fuels, such as premium gasoline or diesel, substitute natural gas or intermediates for the chemical



The SynCat@Beijing Laboratory of Synfuels China Technology Co. Ltd. In Beijing Huairou.



Hans Niemantsverdriet
(Director of SynCat@Beijing).

industry such as methanol, is a sensible option. This is possible by integrating coal technology with green electricity to generate hydrogen and oxygen from water, and in a later stage to reduce greenhouse gases such as carbon dioxide.

The SynCat@Ac@demey has developed and implemented a scientific leadership training programme – what does this programme consist of?

Few universities offer opportunities to develop leadership potential. We started the SynCat@Ac@demey to give our staff the chance to discover their strengths and weaknesses and to become aware of what it takes to become an inspiring

The programme encompasses typical scientific and management skills, such as project, knowledge, contact and conflict management. Then we give insight into theories of effective collaboration and even touch a bit upon practical psychology, asking people to analyse patterns of collaboration in their neighbourhood and make people aware that having team members with different personalities and complementary skills is a great asset for successful research groups.

Ideally, research teams have an open culture where all opinions are valued and respected, and constructive criticism is possible, but personal interests can start to dominate teams, leading to competition

in chemical engineering), might be an efficient way to meet leading scientists in that area in China, and get in contact with their students.

What was the scientific community in China like when you first visited and what is it like now?

My first visit to China was in the early 2000s. Some top universities already had international standing, but most had a largely internal focus. The ability to communicate in English was generally very limited.

Almost twenty years later there are many excellent universities and academy institutes, and several can boast

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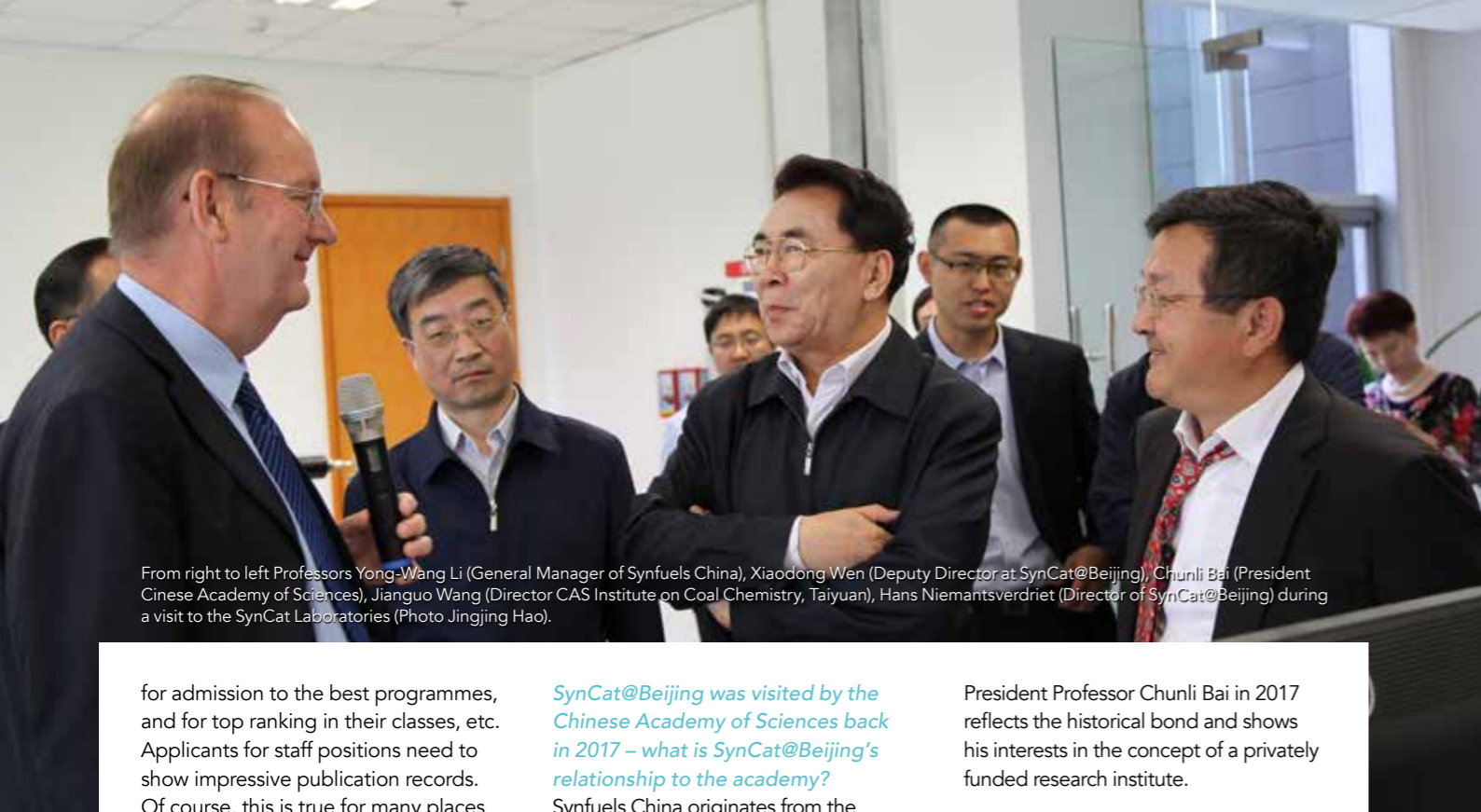
leader. (Book: *Scientific Leadership*, J W Niemantsverdriet and J K Felderhof, De Gruyter, Berlin 2017).

The programme is based on the philosophy that first one must have a working knowledge of management and soft skills, to be able to 'manage oneself' (be a 'self-manager'), then have some insight into how to work effectively with others (be a science manager).

or animosity, indifference about what others do, or worse, indifference to what the organisation achieves.

What attracted you personally to China? Curiosity and the awareness of a huge potential for collaboration. I very much enjoy teaching and interacting with students, and gathered that teaching specialist courses in my own field, catalysis (an important discipline

being at top levels internationally. The academic climate is highly competitive and often focused on acquiring prestige rather than on building consistent and sustainable research programmes of long-term impact. Institutions compete for the best positions in national and international rankings, attracting the best students and staff, and producing high-impact output. Students compete



From right to left Professors Yong-Wang Li (General Manager of Synfuels China), Xiaodong Wen (Deputy Director at SynCat@Beijing), Chunli Bai (President Chinese Academy of Sciences), Jianguo Wang (Director CAS Institute on Coal Chemistry, Taiyuan), Hans Niemantsverdriet (Director of SynCat@Beijing) during a visit to the SynCat Laboratories (Photo Jingjing Hao).

for admission to the best programmes, and for top ranking in their classes, etc. Applicants for staff positions need to show impressive publication records. Of course, this is true for many places in the world, but in China, the emphasis on tangible output and performance as measurable by 'key performance indicators' is particularly strong.

Question is if all universities will be able to establish (or see the value of) a productive academic climate of open exchange of opinions and constructively critical discussion, in a culture where hierarchical relations and seniority are still very important.

SynCat@Beijing was visited by the Chinese Academy of Sciences back in 2017 – what is SynCat@Beijing's relationship to the academy?

Synfuels China originates from the Institute of Coal Chemistry (ICC), which belongs to the Chinese Academy of Sciences, therefore, ties are strong. Though the company is independent, several of its research scientists hold a joint appointment with the ICC. In this way, the company maintains strong connections with the academic world. The SynCat@Beijing laboratory scientists maintain strong academic links with scientists at universities/institutes in China and abroad. The visit of Academy

President Professor Chunli Bai in 2017 reflects the historical bond and shows his interests in the concept of a privately funded research institute.

Strong connections to industrial scientists are a must for academic scientists to engage in research that provides fundamental insights into key industrial processes. This requires very frequent – sometimes daily – contact on how experiments should be conducted to be meaningful in the industrial context and immediate feedback on what exactly the results mean. If such a mechanism of direct interaction is not in place, it is doubtful if scientists can address



Lively discussions during a session of the SynCat Academy's leadership course.

While Europe and the United States have traditionally led scientific development, China has emerged as a new science and technology powerhouse – what are your thoughts on China's fast-growing impact on the world of scientific research? Several Chinese universities and CAS Institutes have research groups that rank among the world elite. We see ambitious research programmes and impressive investments in large national research infrastructure and vast computer power for computational modelling in all scientific disciplines.

Like in the United States and many other places in the world though, science has become extremely competitive, and scientists and their institutions compete for prestige and funding. The logical result is that scientists tend to find their tangible output (high-impact papers, awards, grants received, invitations for talks at prestigious conferences) more important than what they actually contribute to advance science and technology. The risk is focused on short-term successes, while difficult challenges which require patience are avoided. Building a laboratory with a comprehensive research programme and a consistent agenda for longer periods is extremely difficult, and requires institutions where the leadership supports such endeavours by guaranteeing sustained funding.

Why is it important for Chinese research teams to collaborate and

engage with Western research teams? Science is international and ideally without borders. Dividing it into regions is a waste of resources. Collaboration is potentially beneficial for everyone, whether from China or from any other nationality. I have always been impressed by the Chinese policy to send PhD students overseas, with financial support from the Chinese Scholarship Council. Some of my colleagues use it effectively as a vehicle to collaborate on common research topics. There are also several successful bilateral and multilateral programmes for joint research projects, based on agreements between national funding agencies. I think such programmes will become more important in the future.

It is important for Chinese research teams to display their work to a Western audience – should the Chinese be engaging more?

Definitely. Research leaders should have a consistent presence at a few well-chosen international conferences (and not only send their younger staff), participate in international advisory boards, panels and editorial boards and make at least a few visits to leading laboratories, ensuring they maintain personal contact with the trend-setters and thought leaders of their disciplines.

Asian scientists have an additional disadvantage in this respect as the similarity of their family or even full names does not help to distinguish them. For Western people, the variety of names

is much larger, and this is clearly a factor that helps establish a name in a field.

Outreach to a wider public outside China has somewhat lower priority for the moment, but it will come, and certainly if Chinese universities like to attract more foreign students to their campuses.

To find out more, you can visit the SynCat@Beijing website:
<http://syncatbeijing.com/>

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Participants to a SynCat Academy Leadership Course in Leadership (photo Hong Shen).

the right questions, and the outcome may fall into the category of 'inapplicable applied research'. We have practised this philosophy of close interaction with scientists from industry during most of my scientific career, notably in long projects with Shell Amsterdam (1994 to 2005), Sasol South Africa (2000 to 2015)* and now we are building this up with Synfuels China Technology.

* J. van de Loosdrecht, et al. Providing Fundamental and Applied Insights into Fischer-Tropsch Catalysis: Sasol-Eindhoven University of Technology Collaboration. ACS Catalysis 2016;6:3840-3855.



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