



# WHY IT MATTERS... CHEMISTRY



Loughborough  
University

## Xuetong Pei

### Research Student

My project is related to uniting the advantages of both homogeneous and heterogeneous catalysts for generating sustainably important chemical feedstocks.



Owing to rapid population growth, fossil fuels (non-renewable resources) constitute the main source of energy in our lives and fuel resources will be depleted within the next 100 years if demands are not addressed.

The emission of carbon dioxide (CO<sub>2</sub>) to the atmosphere is another reason that traditional fuels need to be reduced. With the increased level of CO<sub>2</sub> and other harmful gases, the environmental issues will be presented, including, increasing Earth surface temperature, climate change, ocean acidification etc. Clean and renewable energy, such as liquid hydrogen fuel and lithium-ion battery are alternatives to fossil fuels. However, the hydrogen storage problem and spatial challenge on transportation make them unsuitable for today's transportation. Therefore, other alternatives of fossil fuels with low CO<sub>2</sub> emissions and more environmentally friendly are important and need to be found.

N-butanol is one of the sustainable resources and can be synthesised by biomass fermentation or transformed from ethanol via a Guerbet reaction (which is one of the reactions I am studying in my research). CO<sub>2</sub> transformations tend to be a popular method in CO<sub>2</sub> utilisation area. The CO<sub>2</sub> methanation that I am studying now can use CO<sub>2</sub> to transform amide to amine which could be reformed again through C-N bond cleavage. The intermediate amide can be used in pharmaceuticals, and the side product, methanol, can be applied in biofuel production.

With respect to the material side, as homogeneous catalyst can introduce really good selectivity for the desired product, the poor recyclability for this catalyst is the major problem. Hence, my research aims to synthesise a catalyst, such as MOF (metal organic framework) material, which is easy to separate from a solution like the heterogeneous catalyst and also retains the catalytic properties for both homogeneous and heterogeneous catalysts. These catalysts will be tested in both Guerbet and CO<sub>2</sub> capture reactions.

#### Post 16 Education

I took my A-levels in China.  
Subject: Fundamental Mathematics,  
Chemistry, Physics, Further mathematics.

#### Higher Education:

BSc Chemistry at Loughborough University



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### Why did you choose to research catalysis?

Because this project is related to catalyst materials and the energy problem that we are experiencing now. I could use my knowledge in catalysis research to develop the material structure which might hopefully improve the efficiency of synthesis biofuels. I also enjoy the challenges associated with characterising the catalyst structure which could provide me with insights into the catalysis pathway and develop new and improved catalytic properties.

**Xuetong's advice:** The reason why I chose chemistry is that it gives me the feeling that I am playing with magic like I am in the world of Harry Potter, unlike physics, you can directly see the object change before your eyes and you experience physics everyday in your life. So I thought that I would like to do more research on this subject.

Therefore, my advice is that experiencing different areas is good and find one that you are interested in and immerse yourself in it. If your inspiration is to find a career with a better salary, yes, you could choose one that fits your criteria, but you might not be happy with it as you force yourself to do something that you don't like. So, you are the one that knows which subject is most suitable for you.

### Xuetong's experience as a student

The lecturers at Loughborough University are extremely helpful and are always available to answer questions if you encounter any problems during my studies. The subject notes that lecturers provided and deliver in the lectures are clear and easy to understand. As my mother language is not English, clear and understandable notes are important for me and helped me enjoy the lectures in my undergraduate study.

Besides, this university provides a good environment for students to have discussions related to their work, for example, the library has different sections for students who want to talk about the work and for quiet work. The lectures are quite interesting; for instance, in the material chemistry lessons, lecturers will bring in models to give a better understanding of the structure and also introduce online 3D models to enable students to probe their understanding.

