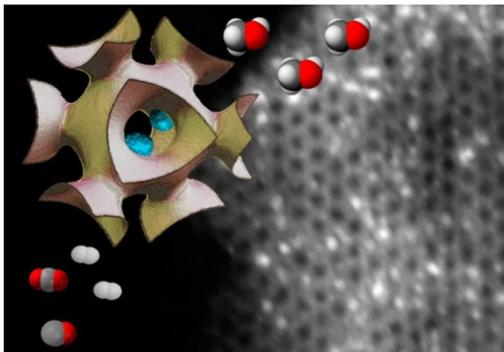


The group of Materials Chemistry and Catalysis (formerly Inorganic Chemistry and Catalysis) is part of the Debye Institute for Nanomaterials Science and is led by prof. Petra de Jongh and prof. Frank de Groot. Other scientific staff members include dr. Peter Ngene and two new staff members dr. Nong Artrith (starting July 2021) and dr. Jessi van der Hoeven (starting October 2021), while prof. dr. Krijn de Jongh will retire in April 2021.



The basic challenge of the work performed in the group is to establish the relationship between the structure and functionality of nanostructured catalysts and (energy) materials, with a focus on sustainability. To achieve this, we work on:

- Design and controlled synthesis of catalysts and energy materials,
- Testing these materials in various processes under realistic conditions,
- Characterization of complex catalyst materials using advanced in-situ spectroscopic and microscopic techniques, and
- Development of theoretical models to fundamentally understand catalysis and energy materials, their properties and functionality.

Focus is on functional materials for Sustainability. Application of these materials is in thermal catalysts (the design of new catalysts for instance for the conversion of CO₂ and renewable H₂ to fuels and chemical building blocks) as well as for the improvement of catalysts (decreasing energy/materials consumption, byproducts, the use of scarce metals) for large scale existing industrial process (methanol synthesis, Fischer Tropsch, hydroisomerisation, ammonia synthesis, epoxidation and other selective hydrogenation and oxidation reactions in both gas and liquid phase). Recently also research on electro- and photocatalysis has become increasingly important. Energy materials include those for the electrocatalytic production of fuels from CO₂ and H₂, reversible hydrogen storage, and battery materials.

Scientific staff:

- Petra de Jongh: Design, fundamentals of preparation, advanced structural characterisation and testing under realistic conditions of new catalysts and energy materials, to allow efficient chemical conversions (decreasing the use of energy and raw materials and limiting CO₂ emissions) and large scale reversible energy storage (to facilitate the energy transition).
- Frank de Groot: Advanced characterisation, for instance using synchrotron- and XFEL-based X-ray spectroscopy.
- Peter Ngene: Focus on energy conversion and storage materials: batteries, renewable hydrogen, and electrocatalysts to produce renewable fuels and chemical building blocks from CO₂ and water.

- Jessi van der Hoeven: Application of advanced electron microscopy techniques such as electron tomography, in situ gas and liquid phase electron microscopy to visualize the structure of catalytic materials in 3D and under operating conditions, and colloidal catalyst synthesis.
- Nong Artrith: Modelling and computational discovery of energy materials as well as interpretation of experimental observations with atomistic first-principles methods (e.g., DFT) and state-of-the-art machine learning.

If you choose to perform a research project in our group, you will work on your own topic and project, and you will be guided by experienced PhD students, as well as two of the staff members. It is your choice to focus more on practical work or theory, but in general you will have the chance to participate in both the design, assembly, advanced characterisation and testing of catalysts or energy materials. You will become acquainted with the advanced range of experimental techniques available (or perform theoretical work directly related to functional materials). As student you will be a member of the group, participate in group and team meetings, discussions and collaborations, and hence develop a strong background in materials research (including analysis and presentation and discussion skills) while working on topics that are relevant for a more sustainable future society.

COLLABORATIONS AND INTERNSHIPS

A project in collaboration with other groups within the Debye is possible. Many of the projects in our group are part of international collaborations, national consortia and/or involve industrial partners. The group facilitates traineeships in chemical industry, Dutch governmental organizations and foreign universities, based on intensive contacts with researchers from national and international companies and universities. We perform synchrotron experiments in Europe, USA and Asia. If you have a specific scientific topic in the field of catalysis in mind, we will do our best to find the right project or internship for you.

REQUIREMENTS

We recommend that you take at least the courses "Advanced Catalysis" and/or "Synthesis of Catalysts and Energy Materials".

FOR MORE DETAILS CONTACT

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or consult our website:

<https://inorganic-chemistry-and-catalysis.eu/information-for-students/>