

SUMMARY REPORT

15th International Summer School on Advanced Studies of Polymer Electrolyte Fuel Cells and Hydrogen

Graz, 28 Aug - 2 Sept 2023

The Summer School on Advanced Studies of Polymer Electrolyte Fuel Cells and Hydrogen was organized for the 15th time in cooperation between **Yokohama National University** and **Graz University of Technology**.



Fig. 1: Announcement of the Summer School.

The goals of this event include deepening the expertise of the participants, international and cultural exchange between researchers, and the opportunity to make new contacts and deepen existing ones. For the first time since 2019, the event was held in person at TU Graz.

Intensive course

The five-day lecture program was opened by Prof. Hacker, who emphasized the long-standing tradition of the summer school and the cooperation between the universities. This year, a total of over 50 participants from eleven countries attended the event.

The international speakers from Austria, Japan, France, Germany, Italy, USA and Slovenia addressed the diverse interdisciplinary topics of fuel cell and hydrogen research and development:

- ❖ **Prof. Hacker (TU Graz) & Prof. Mitsushima (YNU)**: basics and principles of fuel cells
- ❖ **Prof. Gollas (TU Graz)**: electrochemical basics
- ❖ **Prof. Napporn (Univ. Poitiers)**: catalyst synthesis
- ❖ **Prof. Kokoh (Univ. Poitiers)**: kinetics
- ❖ **Prof. Araki (YNU)**: mass transport
- ❖ **Dr. Reimer (D)**: thermodynamics, measurement technology
- ❖ **Prof. Kuroda (YNU)**: measurement technology
- ❖ **Prof. Habrioux (Univ. Poitiers)**: measurement technology
- ❖ **Prof. Bodner (TU Graz) & Dott. Squadrito (CNR)**: fuel cell lifetime
- ❖ **Prof. Katrašnik (Univ. Ljubljana)**: modelling of fuel cell degradation
- ❖ **Berg (AVL)**: fuel cell system development
- ❖ **Prof. Genorio (Univ. Ljubljana)**: carbon materials
- ❖ **Dr. Bock (RGH₂)**: hydrogen production
- ❖ **Außerlechner (TU Graz)**: intercultural awareness.



Fig. 2: Opening of the Summer School by Prof. Hacker.

Workshops and poster session

On the first day, a session on intercultural awareness was given by Manuel Außerlechner (Welcome Center, TU Graz) to demonstrate the Austrian way of living and to build up international friendships among the participants. The half-time of the Summer School was marked by the 6th International Workshop on Hydrogen and Fuel Cells. After the opening by the Dean Prof. Bernd

Nidetzky (Faculty of Technical Chemistry, Chemical and Process Engineering and Biotechnology) and Prof. Hacker, two keynote speakers gave interesting insights into their research:

- **Prof. Etzold (FAU Erlangen Nürnberg):** GDE half-cells for fast ORR-activity assessment
- **Prof. Ha (Washington State University):** hydrogen production by CAPER technology.

Their talks were followed by a poster session, where 32 students presented and discussed their research activities. An international committee headed by Dr. Uwe Reimer awarded **four prizes to students** for the outstanding presentation of their work.



Fig. 3: Michaela Roschger (one of four winners of the student poster award) and Prof. Mitsushima during the student poster session.

Practical trainings

An intensive, theoretical week of talks and presentations was finished by a practical exercise session on thermodynamics, held and organized by Dr. Antonio Atienza-Márquez, Maximilian Grandi, Dr. Uwe Reimer and Sigrid Wolf, to give the students practical insights into the technology applications.



Fig. 4: Maximilian Grandi explains and helps students during the practical exercise.

Social event: A trip to Stübing

On the evening of the first day, there was a guided city tour of downtown Graz. The conclusion of this year's Summer School was a joint excursion to the open-air museum **Stübing**, where farmhouses from all over Austria from different eras were brought together and demonstrated the development of rural life in Austria.

Publication of the lecture materials

The book "From Fundamentals to Applied Research" (Hacker/Mitsushima), 2018, Elsevier, was used as lecture material. The abstracts of the 32 poster presentations are summarized in the **abstract book** ([DOI 10.3217/978-3-85125-973-5](https://doi.org/10.3217/978-3-85125-973-5)).

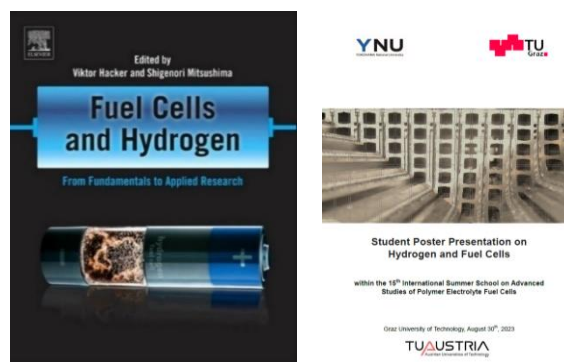


Fig. 5: Lecture notes Fuel Cells and Hydrogen, Elsevier and Abstract Book of the Poster Session.

The contributions in the abstract book cover fuel cell and hydrogen research, starting from catalyst development to research on gas diffusion layers, degradation analysis, hydrogen production and purification.

Further documentation on the summer school can be found at www.tugraz.at/fcsummerschool. The next Summer School on Advanced Studies of Polymer Electrolyte Fuel Cells and Hydrogen is scheduled for early **September 2024 at Yokohama National University**.

Acknowledgement

Our special thanks go to the support of the summer school by all lecturers, the organization by Prof. Hacker, Brigitte Hammer, Bakk. and colleagues, the PhD team on-site for the organization and co-supervision, the financial support by the IEA Research Cooperation on behalf of the Ministry for Climate Protection and Energy (BMK), AVL List GmbH for sponsoring the workshop catering and last but not least the many international active participants.

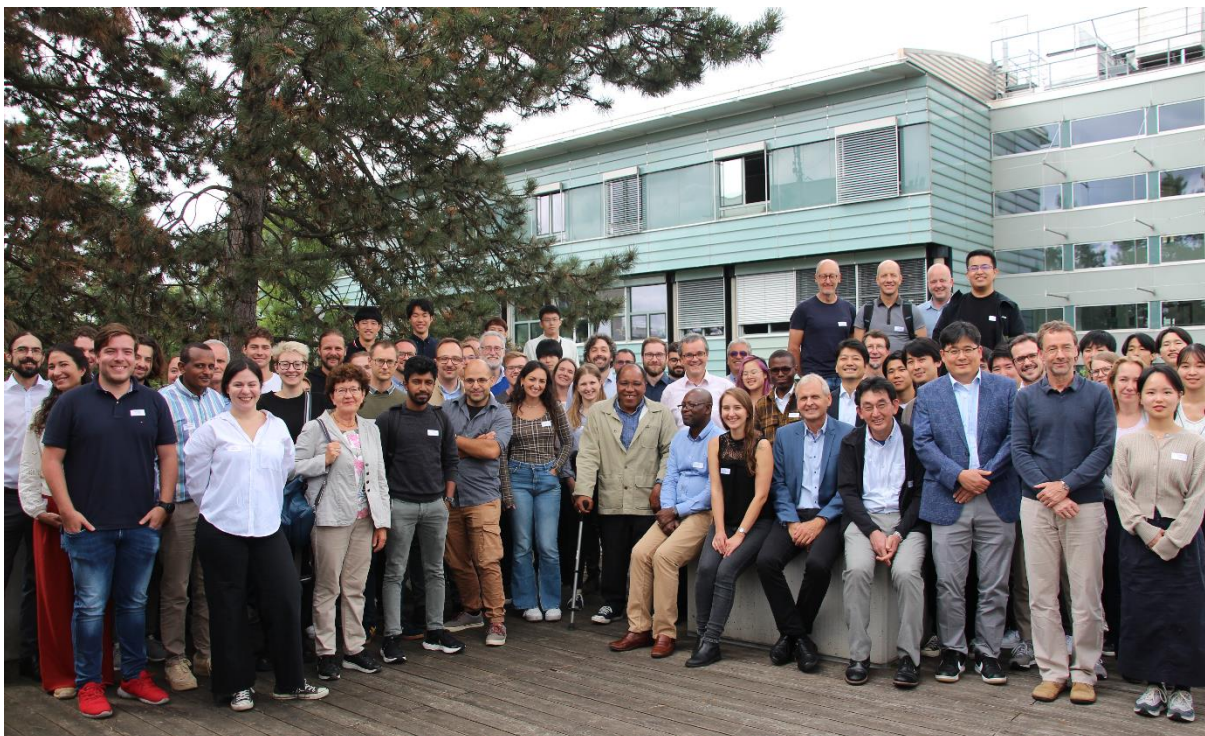


Fig. 6: Group photo of participants, lecturers and keynote speakers from eleven different countries at the 15th Summer School on Advanced Studies of Polymer Electrolyte Fuel Cells and Hydrogen.

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