

Summary report

16th International Summer School on Advanced Studies of Polymer Electrolyte Fuel Cells and Hydrogen

Yokohama, 2-7 September 2024

The Summer School on Advanced Studies of Polymer Electrolyte Fuel Cells was organised for the sixteenth 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. This year, the event was held in Japan at Yokohama National University.

Intensive course

The week was opened by Prof Mitsushima and Prof Hacker, highlighting the long-standing tradition of the Summer School and the ongoing collaboration between the universities. The event attracted **over 70 participants from more than 15 countries**. Distinguished speakers from eight countries covered a wide range of interdisciplinary topics, including fuel cell fundamentals, hydrogen production, and industrial applications.

Interdisciplinary lectures

- ❖ **Prof Hacker (TU Graz) & Prof Mitsushima (YNU):** basics and principles of fuel cells
- ❖ **Prof Gollas (TU Graz):** electrochemical basics
- ❖ **Dr Reimer (D):** thermodynamics
- ❖ **Prof Kokoh (Uni Poitiers):** kinetics
- ❖ **Prof Napporn (Uni Poitiers):** catalyst synthesis
- ❖ **Prof Kuroda (YNU):** measurement technology
- ❖ **Dott Squadrito (CNR):** testing protocols
- ❖ **Prof Bodner (TU Graz):** fuel cell lifetime
- ❖ **Prof Ktrašnik (Uni Ljubljana):** modelling
- ❖ **Prof Araki (YNU):** mass transport
- ❖ **Prof Habrioux (Uni Poitiers):** measurement
- ❖ **Dr Atienza-Márquez (Uni Malaga):** polygeneration
- ❖ **Prof Xing (Uni Surrey):** AI-enabled research



Fig. 2: Opening of the Summer School by Prof Shigenori Mitsushima and Prof Viktor Hacker.

Lab tour and poster session

The week's program also featured a **laboratory tour** at Yokohama National University, where participants had the opportunity to visit the hydrogen research facilities.

In addition to the lab tour, the Summer School included an **International Poster Session** where students presented their research. This session provided a platform for participants to display their work and engage in detailed discussions with other students and experts. The high-quality presentations offered valuable insights into ongoing research and developments in the field, with four students recognized for their exceptional contributions.

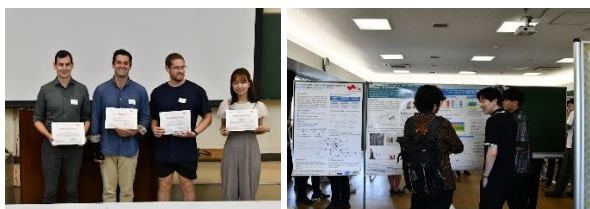


Fig. 3: Poster award winners and impressions of the Poster Session.

Company visit and social events

This year's program featured a special factory visit to **De Nora Permelec Ltd**, a leading manufacturer of electrodes and electrochemical technologies. The visit provided participants with first-hand insights into industrial hydrogen technologies, including advanced electrode production processes and water electrolysis systems used for hydrogen generation. Attendees had the unique opportunity to observe the company's innovative solutions.



Fig. 4: Group photo at De Nora Permelec, Fujisawa.

The program also provided attendees with opportunities to enjoy authentic Japanese cuisine during social events, enhancing both the cultural and social aspects of the experience. After the International Poster Session, where students showcased their research, a catered reception allowed participants to continue discussions in a more relaxed setting. This exchange fostered connections among peers, professors encouraging the sharing of ideas and collaboration.



Fig. 5: Social event and group photo of students in Yokohama Bay.

Publication of the lecture materials

The book "From Fundamentals to Applied Research" (Hacker/Mitsushima), 2018, Elsevier, is used as lecture material. The abstracts of the 25 poster presentations were summarised in the abstract book.

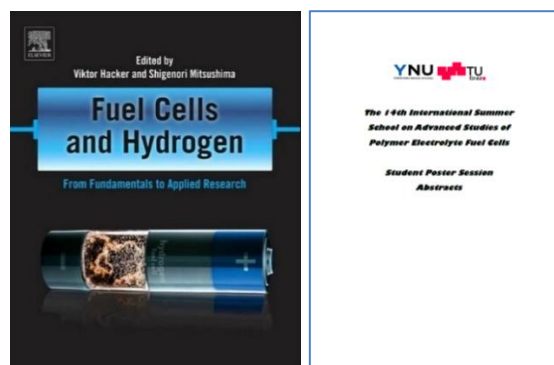


Fig. 6: Lecture notes Fuel Cells and Hydrogen, Elsevier and Abstract Book of the Poster Session.

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, bubbles in electrolyzer systems and the hydrogen storage medium toluene.

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 2025 at Graz University of Technology** in Austria.

Acknowledgement

We would like to express our special thanks for the support of the summer school by all lecturers and the organization and hosting in Japan by Prof Kuroda, Prof Mitsushima and Prof Araki. We would also like to thank the people on site for the organization and technical support, here especially to Brigitte Hammer.

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