

# Japanese-European Research Collaboration of New Affordable and Durable Electrocatalysts for Fuel Cells



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# UN Sustainable Development Global Goals

Renewable energy solutions are becoming cheaper, more reliable and more efficient every day.



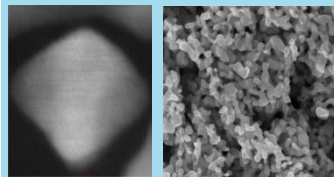
Five targets by 2030 to ensure universal access to sustainable energy:

- Universal access to modern energy
- Increase global percentage of renewable energy
- Double the improvement in energy efficiency
- Promote access to research, technology and investments in clean energy
- Expand and upgrade energy services for developing countries



# Technical Electrocatalysis – Prof. Dr. Mehtap Oezaslan

## Advanced Materials for Energy Conversion and Energy Storage



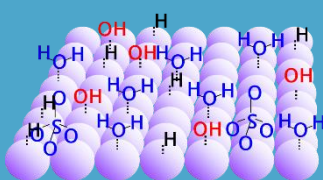
### Design of Materials

#### **Model & Real Electrode Systems**

Spherical mono-metallic & multi-metallic NPs  
Shape-controlled NPs  
Polycrystalline films  
Single Crystals

#### **Synthetic Methods**

Colloidal methods  
Wet impregnation  
Deposition  
Evaporation/Sputter Processes



### Understanding of Electrochemical Reactions

#### **Fuel Cells**

Oxygen Reduction  
Hydrogen Oxidation  
Alcohol Oxidation

#### **Electrolysis**

Oxygen Evolution  
Hydrogen Evolution  
CO<sub>2</sub> Reduction



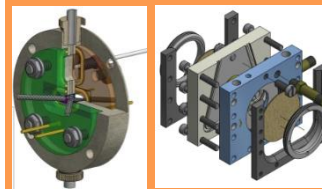
### Development of Electrochemical Tools

#### **Techniques**

Rotating Ring-Disk Electrode (RRDE),  
EC flow cells and  
H<sub>2</sub>-O<sub>2</sub> fuel cell test station

#### **Methods**

Cyclic Voltammetry  
Chronoamperometry  
Linear Sweep Voltammetry  
Impedance Spectroscopy



### Use of Advanced in-situ & ex-situ Tools

#### **Microscopy**

HR-(S)TEM, SEM, AFM,  
ATM

#### **Spectroscopy**

XPS, EDX, EELS, FT-IR,  
Raman, ICP, DEMS,  
XANES, EXAFS

#### **Diffraction**

XRD, HT-XRD



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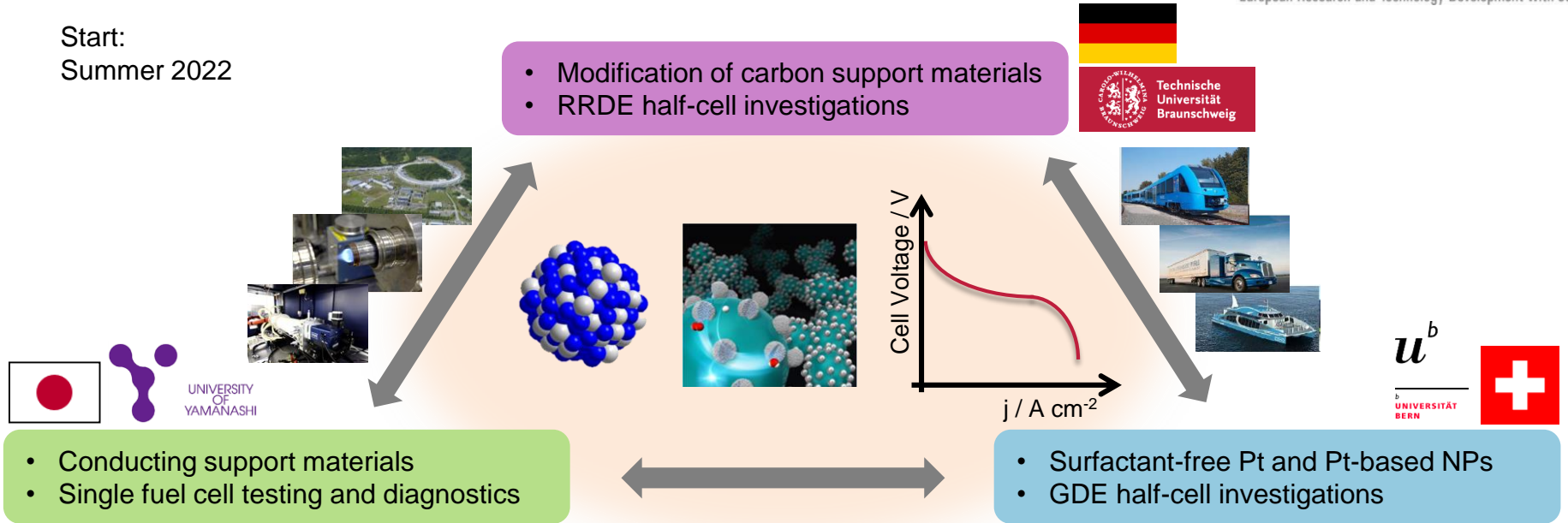
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visit our website

# New Project within the EIG CONCERT Japan Call

Start:  
Summer 2022



Japanese-European Research Collaboration of

**New Affordable and Durable Electrocatalysts for Fuel Cells : NADC-FC**

# University of Yamanashi / Fuel Cell Nanomaterials Center



Prof. Dr. Kakinuma  
Katsuyoshi

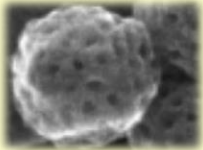


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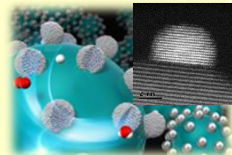
- Fuel Cell Nanomaterials center was established in April 2008 with the support of related ministries and agencies of Japan.
- The full use of the world's top-level advanced experimental systems are equipped to respond to a full-scale hydrogen society, and conducted joint research with industry, academia and government in the world.

## High efficiency



High effective accessible  
carbon support catalyst

## High durability



Highly durable and active  
ceramic support catalyst

## High power



Advanced aromatic membrane  
with high gas barrier & H<sup>+</sup> conductivity

## Latest analysis

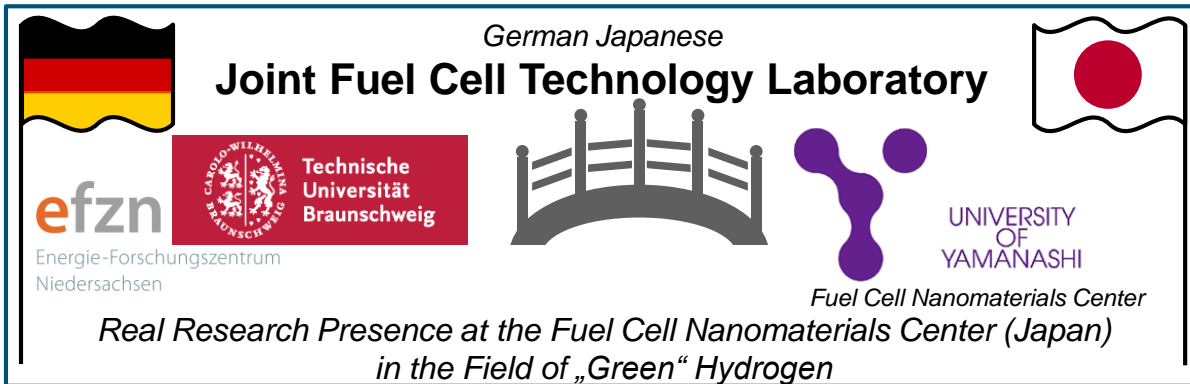


Latest analytical equipment  
Operand / in situ analysis

# Joint Fuel Cell Technology Laboratory

ECatPEMFC<sup>gate</sup>

Joint Laboratory with University of Yamanashi (Japan) • Material Innovation • Fuel Cell • Electrocatalysis • Travel Grant (PhD/MSc, 3-6 month) • Workshops/Conference in Germany • Summer School in Germany and Japan • Incubator for future research projects



German Japanese  
**Joint Fuel Cell Technology Laboratory**

Technische Universität Braunschweig

efzn  
Energie-Forschungszentrum  
Niedersachsen

UNIVERSITY OF YAMANASHI  
Fuel Cell Nanomaterials Center

*Real Research Presence at the Fuel Cell Nanomaterials Center (Japan)  
in the Field of „Green“ Hydrogen*

## Cooperation

**Prof. Dr. Mehtap Oezaslan (Germany)**  
**Dr. Frédéric Hasché (Germany)**  
Technische Universität Braunschweig

**Prof. Dr. Katsuyoshi Kakinuma (Japan)**  
University of Yamanashi  
Fuel Cell Nanomaterials Center

**Prof. Dr. Junji Inukai (Japan)**  
University of Yamanashi  
Clean Energy Research Center

## Funding organization

Federal Ministry of Education and Research (BMBF), Germany

Start: 01. February 2022 for 5 years

## Support (Germany)

Ministry of Science and Culture, State of Lower Saxony  
Ministry of Economy (Lower Saxony) with Representation in Japan (Tokyo)  
Energy Research Centre of Lower Saxony (efzn) with research association Hydrogen  
ECOS Consult



# The Energy Research Centre of Lower Saxony (efzn) is a joint scientific center of five Universities

efzn

Energie-Forschungszentrum  
Niedersachsen

Braunschweig



Clausthal



Göttingen



Hannover



Oldenburg

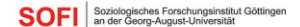


- As central research, networking and communication platform, the EFZN bundles energy research competences from natural and engineering sciences, as well as legal, social and economic sciences (high degree of interdisciplinarity)
- stakeholders in the transformation of the energy system from the fields of science, business, politics and the civil society

## Universitäre Forschungspartner in Niedersachsen



## Außeruniversitäre Forschungspartner in Niedersachsen





GEFÖRDERT VOM



Bundesministerium  
für Bildung  
und Forschung

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