

Joint European Summer School on Fuel Cell, Electrolyser, and Battery Technologies

JESS 2016

*12 – 16 September 2016 (Introductions)
and*

19 – 23 September 2016 (Specialisation Classes)

Hotel Amarilia, Athens, Greece



INTRODUCTION

The Joint European Summer School JESS 2016 will be held in Vouliagmeni, close to the beautiful city of Athens. Once again it will provide highly condensed high level courses on selected topics of fuel cells, electrolyser, and battery technologies, this year adding a Modelling Master Class, and modules on Business Development and Fuel Cell Vehicles.

The increase in energy production from renewable sources creates a demand for energy storage technologies. Storage and conversion can be accomplished electrochemically, in batteries or chemically through electrolysis and fuel cells. Therefore, these technologies are predestined to play a major role in the energy production infra-structure of the near future.

During the Summer School, the main focus will be on the technological aspects. Starting from the fundamental principles of electrochemistry and thermodynamics, the entire spectrum of materials, design and balance of plant will be covered both from an engineering point of view as well as from a modelling and market development perspective. In addition to the lectures, the participants will be asked to join in student projects where the content of the lectures can be applied to a case study to be presented at the end of the week.

Week 1 offers the three introductory courses to high and low temperature fuel cells and electrolyzers, and the battery technology course. These courses are accredited at the three universities organizing the Summer School and carry 3 ECTS points (see below).

Week 2 offers the three specialised courses in Modelling (Master Class), Fuel Cell Vehicles and Business Development. These courses are not accredited (yet).

The two weeks are conducted independently of each other and students can choose the most appropriate courses to their studies.

The Summer School targets an audience of university students and young professionals within the fields of fuel cells, hydrogen production and batteries. The lectures are designed for MSc-students, PhD-students, and Post-Doctoral researchers. More experienced researchers and engineers wishing to review the technologies addressed and expand their knowledge, for instance, to possibly suit a newly acquired position, will also greatly benefit from attending. The topical content is tailored to the needs of a diverse audience: newcomers to the field, experienced students, and young professionals working at the forefront of fuel cell and battery applications.

The school draws on the knowledge and expertise of a selected group of lecturers currently working at the leading edge of fuel cell, hydrogen, battery, and market research and development in Europe and associated to universities, national research centres and industry.

Informal networking is a key element of science and scientific work in general. The Joint European Summer School on Fuel Cell, Electrolyser and Battery Technologies offers ample opportunity for networking between young professionals and eminent scientists. Students are given a mini-project to work on in small teams and asked to give a short introduction to themselves and the research work they are doing (or expect to be doing).

CERTIFICATE OF ATTENDANCE

A Certificate of Attendance shall be issued to all students of the Joint European Summer School on Fuel Cell, Electrolyser and Battery Technologies. This Certificate of Attendance can also be used for acquiring CPD points. The courses **of the first week** are accredited at the universities of Aachen and Birmingham as well as the Danish Technical University. On taking the optional final exam of their respective course, students can gain 3 ECTS points.

ORGANISING COMMITTEE

Prof Rüdiger-A. Eichel (Forschungszentrum Jülich, Germany)

Prof Jens Oluf Jensen (DTU Energy Conversion, Denmark)

Prof Robert Steinberger-Wilckens (U Birmingham, United Kingdom)

LOCATION & VENUE

Athens is the capital and largest city of Greece. Athens dominates the Attica region and is one of the world's oldest cities, with its recorded history spanning around 3,400 years. Classical Athens was a powerful city-state. A centre for the arts, learning and philosophy, home of Plato's Academy and Aristotle's Lyceum, it is widely referred to as the cradle of Western civilization and the birthplace of democracy, largely due to the impact of its cultural and political achievements during the 5th and 4th centuries BC in later centuries on the rest of the then known European continent. The heritage of the classical era is still evident in the city, represented by ancient monuments and works of art, the most famous of all being the Parthenon, considered a key landmark of early Western civilization. The city also retains Roman and Byzantine monuments, as well as a smaller number of Ottoman monuments. It is home to two UNESCO World Heritage Sites, the Acropolis of Athens and the medieval Daphni Monastery. Landmarks of the modern era, dating back to the establishment of Athens as the capital of the independent Greek state in 1834, include the Hellenic Parliament (19th century) and the Athens Trilogy, consisting of the National Library of Greece, the Athens University and the Academy of Athens.

The hotel hosting the school is located only steps away from a sandy beach in the Vouliagmeni area, 17 km from Athens city centre and 19 km from Athens international airport. All rooms have individual controlled A/C, free WiFi internet access, hairdryer, mini fridge, LCD TV and DVD player. More details can be found at <http://www.amarilia.gr/>. Participants wishing to arrive early or stay longer should make their own arrangements with our contact and cooperating partner: Panhellas Tourism & Congress (**Mrs Manuela Drape Stathoglou**, Mail: manuela@panhellas.gr, Tel: 0030 2810 300847, Fax: 0030 2810 300848).

Reaching Amarilia Hotel from Athens international airport 'Eleftherios Venizelos'

By bus

There is 24-hour bus service at the arrivals terminal in Athens international airport (Eleftherios Venizelos). The trip to the closest bus station to Amarilia Hotel (named 'Pigadakia') takes approx. 35-40 minutes and the cost is € 5,00. From the bus station 'Pigadakia' you turn left on the main avenue and walk 10 minutes before you arrive at Amarilia Hotel, on the right side of the main avenue.

By car

You drive on the highway until the KOROPÍ - MARKOPOULÓ sign and you exit to the left. Then you follow the signs to GLYFADA and drive along the Vari - Koropi Avenue at the end of which there is a sign VOULIAGMENI where you turn left. After 300m, you reach a traffic light; you turn right in the small street 15m after the traffic lights, then right in the first street and then right to Agiou Nikolaou street. This is VOULIAGMENI area and it is where our hotel is located. The distance from the Airport is 19km (20 minutes driving distance).

CORRESPONDENCE

Student registration and financial matters

1st week: JESS@fz-juelich.de; Phone +49 2461 61-2244, Fax +49 2461 61-9550

2nd week: J.C.Hooper@bham.ac.uk; Phone: +44 121 414 5275

Lecturers/other information - jo.mertens@fz-juelich.de, Phone +49 2461 61-6706

PARTICIPATION FEE

To register, fill in one of the forms attached at the end of this document, scan, and send to the e-mail addresses on the form. Or follow the registration links on the web site

<http://www.jess-summerschool.eu/JESS-2016>

The registration fee is 1.280,- €/week and covers tuition fees, accommodation in single room (double room occupancy = 1.150,- €) from 11 to 17 Sept, resp. 18 to 24 Sept, full board, banquet and excursion.

The deadline for registration is **31 August 2016**.

CANCELLATION POLICY

To cancel your registration with JESS, send an email stating your intent to

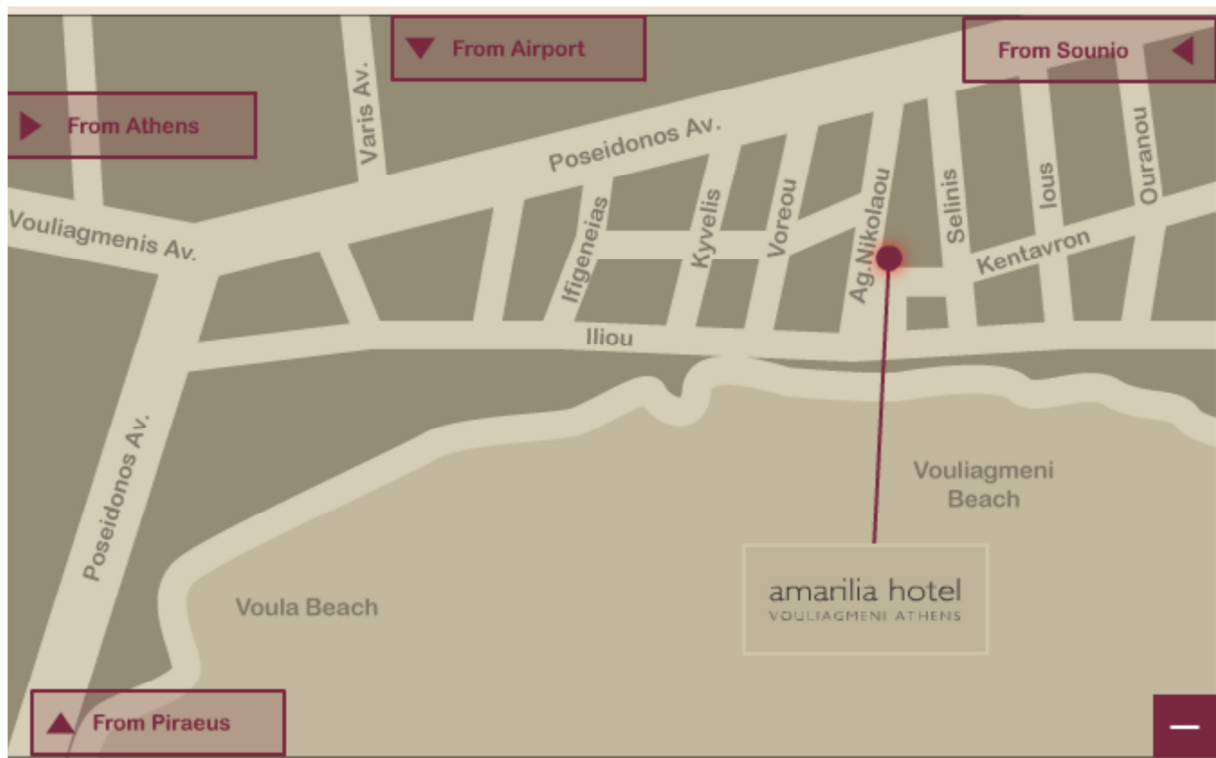
JESS@fz-juelich.de (1st week)
j.c.hooper@bham.ac.uk (2nd week)

Refunds will be subject to a cancellation fee. If your request arrives by 01 September 2016, the registration fee will be refunded after the school applying a cancellation fee of 350,00 € of the processed registration fee. No reimbursement will be made for cancellations received after 01 September 2016.

To cancel any additional services booked with Panhellas (see below), please direct your request to Panhellas directly at the address(es) shown.

LIABILITY

The school secretariat and organizers cannot accept liability for personal accidents, loss of or damage to private property of participants and/or accompanying persons, either during, or directly arising from the JESS 2016. Participants should make their own arrangements with respect to health and travel insurance.



JESS 2016 - Programme WEEK 1

Module 1	Introduction to SOFC / SOEC		Joint lectures		
			Introduction to LT Fuel Cells and Electrolysers		Introduction to Batteries
Module 2					
Module 3					
Sunday	11 Sep 2016				
			Arrival		
Monday	12 Sep 2016				
08:00 08:30	Registration				
08:30 09:00			Welcome and General Introduction	Jens Oluf Jensen (DTU)	
09:00 09:45			Sustainable and Renewable Energy Future	Rüdiger-A. Eichel (FZJ)	
09:45 10:00	coffee break		coffee break		coffee break
10:00 11:15			Introduction to Batteries	Rüdiger-A. Eichel (FZJ)	
11:15 11:30	break		break		break
11:30 12:45			Introduction to Fuel Cells and Electrolysis	Robert Steinberger-Wilkens (U Bham)	
13:00 14:00	lunch				
16:00 17:30			Thermodynamics and Efficiency of Electrochemical Cells	Jens Oluf Jensen (DTU)	
17:30 18:00	coffee break		coffee break		coffee break
18:00 19:30			Introduction to Solid State Chemistry & Ionics	Rüdiger-A. Eichel (FZJ)	
19:30 19:45			Introduction to the Students' Project	Robert Steinberger-Wilkens (U Bham)	
19:45 21:15	welcome reception / dinner				
21:15 22:00			Students' Presentations I	Jens Oluf Jensen (DTU)	
Tuesday	13 Sep 2016				
	Introduction to SOFC / SOEC		Introduction to LT Fuel Cells and Electrolysers		Introduction to Batteries
08:30 09:45	Electrolyte materials for SOFC / SOEC	Alan Atkinson (ICL)	Electrolyte materials for LT fuel cells and electrolysers	Marcelo Carmo (FZJ)	Cell and Pack designs for batteries
09:45 10:00	coffee break		coffee break		coffee break
10:00 11:15	Anode materials for SOFC / SOEC	Alan Atkinson (ICL)	Catalyst and kinetics for LT fuel cells and electrolysers I.	Lars Cleemann (DTU)	Manufacturing of batteries
11:15 11:30	break		break		break
11:30 12:45	Cathode materials for SOFC / SOEC	Alan Atkinson (ICL)	Catalyst and kinetics for LT fuel cells and electrolysers II.	Lars Cleemann (DTU)	System technology and safety for batteries
13:00 14:00	lunch				
16:00 17:15	Cell and Stack designs for SOFC / SOEC		Cells, bipolar plates, and stacks for LT fuel cells	Lars Cleemann (DTU)	Anode materials for batteries
17:15 17:30	coffee break		coffee break		coffee break
17:30 18:45	Manufacturing of SOFC / SOEC		Cells, bipolar plates, and stacks for LT electrolysers	Marcelo Carmo (FZJ)	Cathode materials for batteries
18:45 19:00	break		break		break
19:00 20:15			Students' Presentations II	Jens Oluf Jensen (DTU)	
20:30 21:30	dinner				
Wednesday	14 Sep 2016				
	Introduction to SOFC / SOEC		Introduction to LT Fuel Cells and Electrolysers		Introduction to Batteries
08:30 09:45	Exercise on materials / design	Ico Vinke (FZJ)	Hydrogen compression and storage	Jens Oluf Jensen (DTU)	All solid state batteries
09:45 10:00	coffee break		coffee break		coffee break
10:00 11:15	System technology for SOFC	Ico Vinke (FZJ)	System design and operation for LT fuel cells	Jens Oluf Jensen (DTU)	Metal-Air batteries
11:15 11:30	break		break		break
11:30 12:45	Degradation in SOFC / SOEC	Anke Hagen (DTU)	System design and operation for LT electrolysers	Marcelo Carmo (FZJ)	Exercise on materials (/ design)
13:00 14:00	lunch				
15:00 20:45	Excursion				
21:00 22:00	dinner				
Thursday	15 Sep 2016				
	Introduction to SOFC / SOEC		Introduction to LT Fuel Cells and Electrolysers		Introduction to Batteries
08:30 09:45			Characterisation Methods for Fuel Cell, Electrolyser and Battery Materials	Shangfeng Du (U Bham)	
09:45 10:00	coffee break		coffee break		coffee break
10:00 11:15			Exercise on Characterisation, Electrochemistry and Thermodynamics	Shangfeng Du (U Bham)	
11:15 11:30	break		break		break
11:30 12:45			Student project time	n/a	
13:00 14:00	lunch				
16:00 17:00	System technology for SOEC	Oliver Posdziech (SunFire)	Challenges for LT electrolysers	Marcelo Carmo (FZJ)	Electrolyte materials for batteries
17:00 17:15	coffee break		coffee break		coffee break
17:15 18:30	Exercise on system technology	Robert Steinberger-Wilkens (U Bham)	Challenges for LT fuel cells	Lars Cleemann (DTU)	Transport modelling of batteries
18:30 18:45	break		break		break
18:45 19:45			Atomistic Modelling in fuel cell, electrolyser and battery research	Juan Maria Garcia Lastra (DTU)	
20:00 21:00	dinner				
Friday	16 Sep 2016				
	Introduction to SOFC / SOEC		Introduction to LT Fuel Cells and Electrolysers		Introduction to Batteries
08:30 09:45	Exercise on degradation	Anke Hagen (DTU)	Application of LT fuel cells and electrolysers	Lars Cleemann (DTU)	Beyond Lithium - resource-efficient batteries
09:45 10:00	coffee break		coffee break	with Marcelo Carmo(FZJ)	coffee break
10:00 11:15	New trends in SOFC / SOEC	Anke Hagen (DTU)	New trends in LT fuel cells and electrolysers	Jens Oluf Jensen (DTU)	Degradation and Lifetime-Prediction in batteries
11:15 11:30	break		break		break
11:30 12:45	Power to Gas, Fuels and Chemicals			Oliver Posdziech (SunFire)	Exercise on in-operando characterization & degradation
13:00 14:00	lunch				
16:00 17:00			ECTS exams	all	
17:00 17:15	coffee break		coffee break		coffee break
17:15 18:45			Students' projects presentations	Robert Steinberger-Wilkens (U Bham)	
18:45 19:00	break		break		break
19:00 19:30			Farewell	Robert Steinberger-Wilkens (U Bham)	
20:30 open	Gala dinner				

Module 1	Fuel Cell Vehicles		Joint lectures			
Module 2			Modelling Master Class			Fuel Cell & Hydrogen Business Development
Module 3						
Sunday	18 Sep 2016		Arrival			
Monday	19 Sep 2016					
08:00	08:30	Registration				
08:30	09:00					
09:00	09:45	Welcome and General Introduction Sustainable and Renewable Energy Future		Robert Steinberger-Wickens (U Bham) Robert Steinberger-Wickens (U Bham)		
09:45	10:00	coffee break				coffee break
10:00	11:15	Introduction to Fuel Cell Vehicles & Markets		Ferdinand Panik (U Esslingen)		coffee break
11:15	11:30	break				break
11:30	12:45	Electromobility: Business Cases & Services		Robert Steinberger-Wickens (U Bham)		break
13:00	14:00	lunch				
		Fuel Cell Vehicles		Modelling Master Class		Fuel Cell & Hydrogen Business Development
16:00	17:30	Status of FC passenger cars & buses	Ferdinand Panik (U Esslingen)	Basics of FC Modelling and Mathematical Tools pt. 1	Alessio Alexiads (U Bham)	Innovation Management
17:30	18:00	coffee break		coffee break		coffee break
18:00	19:30	Designing and building hydrogen fuel cell vehicles	Thomas von Unwerth (U Chemnitz)	Basics of FC Modelling and Mathematical Tools pt. 2	Alessio Alexiads (U Bham)	Financing a business
						Emma Vartolomei (AISIStreet)
19:30	19:45			Introduction to the Students' Project	Robert Steinberger-Wickens (U Bham)	
19:45	21:15	welcome reception / dinner				
21:15	22:00			Students' Presentations I	students	
Tuesday	20 Sep 2016					
		Fuel Cell Vehicles		Modelling Master Class		Fuel Cell & Hydrogen Business Development
08:30	09:45	Drive Train Components (1)	Thomas von Unwerth (U Chemnitz)	Introduction to MATLAB	Alessio Alexiads (U Bham)	Introduction to Business Development
09:45	10:00	coffee break		coffee break		coffee break
10:00	11:15	Lightweight structures for overall vehicle efficiency	Robert Steinberger-Wickens (U Bham)	CFD Modelling	Murat Peksen (FZJ)	Creativity & Ideation
11:15	11:30	break		break		break
11:30	12:45	Vehicle Fuel Cells & Fuel Cell Systems	Ferdinand Panik (U Esslingen)	Thermomechanical modelling	Murat Peksen (FZJ)	Patents and Copyrights
						James Wilkie (U Bham)
13:00	14:00	lunch				
16:00	17:15	Exercise 1	Thomas von Unwerth (U Chemnitz)	From 0d to 3d modelling	Tsang-I Tsai (U Bham)	Exercise 1
						James Wilkie (U Bham)
17:15	17:30	coffee break		coffee break		coffee break
17:30	18:15			Introduction to Fuel Cell Business Futures	James Wilkie (U Bham)	
18:15	18:30	break		break		break
18:30	19:45			Students' Presentations II	students	
20:00	21:00	dinner				
Wednesday	21 Sep 2016					
		Fuel Cell Vehicles		Modelling Master Class		Fuel Cell & Hydrogen Business Development
08:30	09:45	Hybrid vehicle drive trains	Robert Steinberger-Wickens (U Bham)	Thermodynamical and Kinetics Modelling	Tsang-I Tsai (U Bham)	Market Introduction Strategies
						Brigit Thoben (Bosch)
09:45	10:00	coffee break		coffee break		coffee break
10:00	11:15	Vehicle Batteries	Robert Steinberger-Wickens (U Bham)	Multiphysics modelling	Murat Peksen (FZJ)	Case Studies I: Ideation
						Brigit Thoben (Bosch)
11:15	11:30	break		break		break
11:30	12:45	Exercise 2	Thomas von Unwerth (U Chemnitz)	Student project 1	Student	Funding Sources
						Emma Vartolomei (AISIStreet)
13:00	14:00	lunch				
15:00	20:45			excursion		
21:00	22:00	dinner				
Thursday	22 Sep 2016					
		Fuel Cell Vehicles		Modelling Master Class		Fuel Cell & Hydrogen Business Development
08:30	09:45			Electromobility: System Modelling	Robert Steinberger-Wickens (U Bham)	
09:45	10:00	coffee break		coffee break		coffee break
10:00	11:15	Drive Train Components (2)	Thomas von Unwerth (U Chemnitz)	Exercise / Discussion	Murat Peksen (FZJ)	Due Dilligence, Investment Decisions, Technology Deals
11:15	11:30	break		break		break
11:30	12:45	Drive Train Components (3)	Thomas von Unwerth (U Chemnitz)	Student project 2	Student	Case Studies II
						Silash Ruparell
13:00	14:00	lunch				
16:00	17:00	FCV System Analysis WTW, TCO, LCA	Ferdinand Panik (U Esslingen)	Exercise / Discussion 2	Tsang-I Tsai (U Bham)	Exercise 3
						Emma Vartolomei (AISIStreet)
17:00	17:15	coffee break		coffee break		coffee break
17:15	18:30	Exercise 3	Ferdinand Panik (U Esslingen)	Student project 3	Student	Business Case Study
18:30	18:45	break		break		break
18:45	19:45			Student project time	students	
20:00	21:00	dinner				
Friday	23 Sep 2016					
		Fuel Cell Vehicles		Modelling Master Class		Fuel Cell & Hydrogen Business Development
08:30	09:45	Exercise 4	Ferdinand Panik (U Esslingen)	Student project 4	Student	Exercise 4
09:45	10:00	coffee break		coffee break		coffee break
10:00	11:15	Outlook & Scenarios	Ferdinand Panik (U Esslingen)	Exercise / Discussion 3	Alessio Alexiads (U Bham)	Outlook
11:15	11:30	break		break		break
11:30	12:45			Student project time	students	
13:00	14:00	lunch				
16:00	17:00			Electromobility: The Energy & Environmental Perspective	Robert Steinberger-Wickens (U	

Joint European Summer School for Fuel Cell, Electrolyser, and Battery Technologies

Solid Oxide Fuel Cells & Electrolysers ☐

Low Temperature Fuel Cells & Electrolysers ☐

Batteries ☐

Hotel Amarila
11 – 17 September 2016, Vouliagmeni (Athens), Greece

Deadline for registration: **31st August 2016**

Title	
First name	
Last name	
Gender	Male <input type="checkbox"/> Female <input type="checkbox"/>
University/Institution/Company Name	
Street / P.O. Box	
Postal code	
Town/City	
Country	
Phone	
Fax	
E-mail :	
Athens arrival date and time	
Athens departure date and time	
Please note any special dietary requirements, disabilities etc. that we may need to know about	

PLEASE RETURN BY E-MAIL OR FAX TO

Mrs. Chantal Hake at JESS@fz-juelich.de or Fax +49 2461 61 9550
You will then receive a confirmation and an invoice for the meeting fee.

Joint European Summer School for Fuel Cell, Electrolyser, and Battery Technologies

Fuel Cell Vehicles ☐

Modelling Master Class ☐

(Fuel Cell) Business Development ☐

Hotel Amarila
18 – 24 September 2016, Vouliagmeni (Athens), Greece

Deadline for registration: **31st August 2016**

Title	
First name	
Last name	
Gender	Male <input type="checkbox"/> Female <input type="checkbox"/>
University/Institution/Company Name	
Street / P.O. Box	
Postal code	
Town/City	
Country	
Phone	
Fax	
E-mail :	
Athens arrival date and time	
Athens departure date and time	
Please note any special dietary requirements, disabilities etc. that we may need to know about	

PLEASE RETURN BY E-MAIL OR FAX TO

Mr. John Hooper at j.c.hooper@bham.ac.uk

Or follow the e-shop link on the Summer School web site

<http://www.jess-summerschool.eu/JESS-2016>

You will then receive a confirmation and an invoice for the meeting fee.