

### Aims

- High power-density
- High efficiency
- Durability
- Low air stoichiometry

### R&D activities

- Durability testing of single cells
- Studies of effects of impurities on electro-chemical performance
- Adaption of layer design onto improved materials

### Equipment

- Electrochemical test facilities
- Permeability measurements
- Coating facilities
- Fuel cell lab

### DMFC in Jülich

**2016**  
UPS system  
in field test



**2012**  
20,000 h durability



**2007**  
real fork lift  
system



**2005**  
1<sup>st</sup> integrated system



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# Direct Methanol Fuel Cell Systems



**Power Units for  
Light Traction and Uninterruptable  
Power Supply Applications**



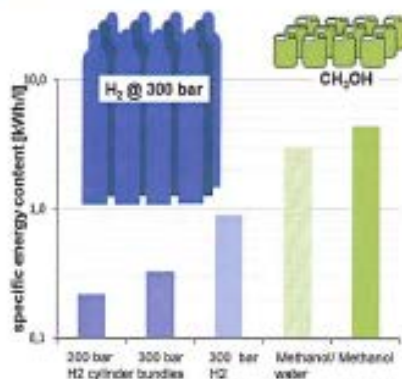
## Direct Methanol Fuel Cells (DMFC)

Electricity generation from methanol

DMFCs directly convert the liquid fuel methanol into electric current. In comparison to other fuel cell systems that operate with pure hydrogen or hydrogen-rich gases from reforming processes, the fuel is supplied directly.

### Methanol (Methanol/Water) or Hydrogen

- **Methanol**
  - Energy density (4,42 kWh/l)
  - Large range without refueling (1,2 kWh/l)
- **Liquid Fuel**
  - Easy refilling
  - Easy handling
- **As biofuel available**
  - Closed CO<sub>2</sub>-loop



Direct methanol fuel cells are attractive for various applications, since DMFC systems permit longer operating times due to the high energy density of methanol. Apart that, the DMFC is characterized by easy handling and trouble-free refueling.

### Advantages of a DMFC:

- long operation times/large range
  - high energy density of methanol
  - efficient conversion
- fast refuelling
- simple system setup

## DMFC-Stack-Development



### Aims

- High Power Density
- Durability
- Quality assurance
- Graphite and metallic bipolar plates
- Safe and durable sealing

### R&D activities

- Design and construction of Stacks
- Automated stack assembly
- Advanced operation mode

### Equipment

- Automated durability test facilities
- Robot assisted stack assembly
- Electrochemical test facilities
- Permeability measurements

## DMFC-System-Development



### Aims

- Power Density (> 50 W/l)
- Hybridization
- Durability (> 20,000 h in operation and > 10 years in stand-by)
- System efficiency (>35%)
- Closed water loop up to >40°C ambient temperature

### R&D activities

- Durability testing of systems
- Development of water management
- Test of system components
- Development of systems hybridization

### Equipment

- Automated durability test facilities
- Climate-testing laboratory
- Air humidification test facility
- FTIR gas analytics
- Two flexible test fields