Direct utilization of bio-fuels in solid oxide fuel cells for sustainable and decentralised production of electric power and heat (DIRECTBIOPOWER)

Project overview (2017FCFYHK_004)

1. Develop a new generation solid oxide fuel cell stack based on advanced ceramic materials for the direct utilization of biofuels to reduce the complexity of the balance-of-plant and produce electrical power and heat with high overall efficiency (~90 % CHP, >50% electrical efficiency).

2. The system should be characterized by a high sulphur tolerance (up to 100 ppm), life-time perspective > 40000 hrs, capability to sustain >1000 redox-thermal cycles as well as load cycles.

3. The project aims at developing an exsolved perovskite catalytic pre-layer used at the anode to mitigate carbon deposition and anode poisoning by sulphur and carbon.

4. Solid oxide fuel cell materials will be tailored for operation at intermediate temperatures (500-750 °C) (ceria-gallate or tin film YSZ electrolytes, innovative perovskites cathodes) to reduce degradation issues while allowing the use of ferritic steel for the interconnects with consequent lower costs and increased reliability.

5. The final goal is the demonstration of a kW-size SOFC (0.5-1kW) system fed directly with partially de-sulphurised biofuels (bio-ethanol, glycerol, bio-gas) as a proof-of-concept of the process.

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