PROJECT CONTEXT

Current automotive PEM fuel cell stack manufacturing is very much oriented towards meeting the volume requirements of the day. Stacks are invariably built using components which in some cases are selected based on bespoke quality requirements. As a result manufacturing throughput is too slow and high in cost to meet the 2020 targets.

For PEM fuel cells to make a significant impact on the modern auto-industry in the EU, development of the manufacturing approach to all components must be made to facilitate high volume automated manufacture and inspection capability throughout the supply chain.

The DIGIMAN project will raise the manufacturing level by introducing enhanced design for assembly, automated processes for assembly and inspection, coupled with materials acceptance standards.

PROJECT DETAILS

Start date: January 2017
Duration: 3 years
Type of action: Research and Innovation
Manufacturing technologies for PEMFC stack components and stacks

PROJECT CONSORTIUM

The project involves 6 partners, **CEA Tech - LITEN, France** coordinates the project activities and contributes to the characterisation of GDL physical properties and performance. **Pretexo, France** provides project management support and leads dissemination activities. Other major European companies are part of the consortium. **Intelligent Energy, UK**, is technical lead for the project, owning the design of the fuel cell stack and defines acceptable manufacturing tolerances for component and assembly processes for high volume production requirements. **Toyota Motor Europe, Belgium** provides its solid scientific knowledge towards automotive manufacturing KPI /requirements and technology evaluation and. **Freudenberg Performance Materials, Germany,** takes the lead on gas diffusion layer properties and requirements, whilst academic partner **Warwick Manufacturing Group, United Kingdom**, takes a leading role in the proof-of-process (PoP) development of the automated fuel cell assembly system.

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DigiMan

DIGItal MANufacturing and Proof-of-Process for Automotive Fuel Cells

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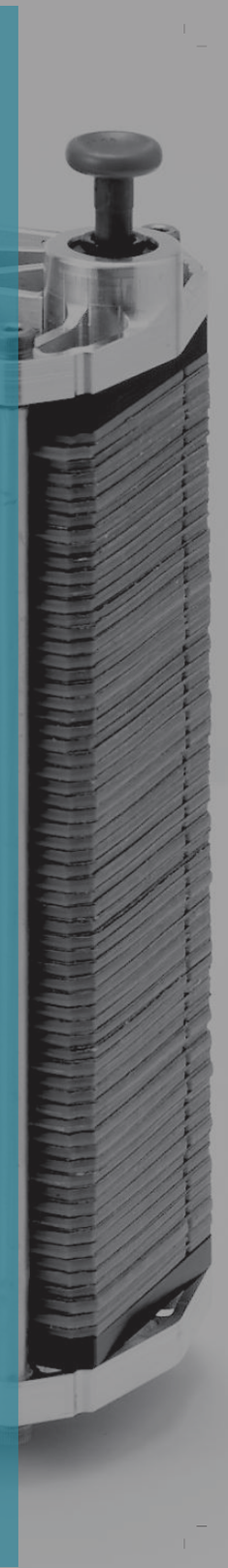
www.digiman.eu

FCH2 JU grant N°: 736290



PROJECT OBJECTIVES

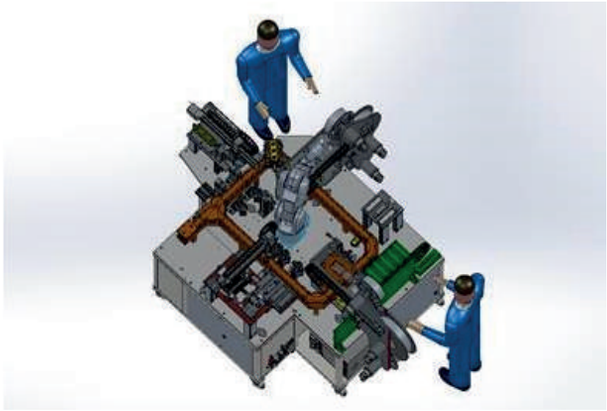
The overriding aim of DIGIMAN, an industry led and commercialisation focused project, is to develop an EU-centric production capability for automotive PEM fuel cell stacks and their key components with volume manufacturing scalability and embedded quality control at its heart. The stack and components will be based on Intelligent Energy's proprietary PEM fuel cell technology for automotive zero emission range extender applications.

SPECIFIC OBJECTIVES

- Delivering automated manufacturing maturity to fuel cell stack and components
- Establishing an integrated European supply chain for key fuel cell components with seamless digital manufacturing and digital quality control
- Embedding quality in automotive stack production via uplifted automation in the form of a 'blueprint' reference design, as validated to MRL6 via proof-of-process demonstrator equipment and virtual simulations of a 'digital twin'
- Demonstrate automotive best practice, for example fixed rate flow lines with bypass loops for interrupt mitigation (intervention/buffering)

TECHNICAL APPROACHES

DIGIMAN, five technical work packages (WP2 - WP6)



3D Model of Proof-of-Process (PoP) demonstration equipment

Specific Targets

- Demonstrate, via the uplifted automation, blueprint design to scale to production capacity >50,000 stacks/year by 2020
- Demonstrate for a single line a total stack power output of >5MW
- Demonstrate more than a fourfold cell assembly cycle time step processing improvement from semi-auto to full-auto.
- Advance fully automated stack manufacturing technology level to MRL6
- Develop in-process quality controls at component and sub-component level to reduce scrap rate to target <3%
- Model costs showing target trajectories consistent with automotive targets for 2020
- Ensure that the stack performance is not detrimentally affected by the improvements for fully automated manufacturing and assembly delivering class leading stack power densities.

As part of **WP2**, we have definitions of automotive best practice and specification of baseline KPIs for the emergent fully automated stack assembly system. Fuel cell stack commissioning handover performance targets and manufacturing metrics are agreed, providing performance benchmarks for uplifted automation.

The aim of the work package **WP3** is to address an industry wide gap in the supply chain processes for the converting of imperfect roll-stock into pre-screened (i.e. known-good), ready for assembly, GDL components via the development of a Digital QC & Converting module, which directly interfaces with the PoP demonstrator and enable lines-side converting.

WP4 focuses on the proof-of-process (PoP) development of an automated fuel cell assembly system, the output of which should be capable of linking with Intelligent Energy's existing automated stack assembly module. A novel modular reconfigurable PoP facility is envisaged.

WP5 objectives is to correlate functional properties, microstructural properties and FC performances and to define non destructive methods for in line characterisation. Efficient quality control methods will require the development of a database of gas diffusion layer empirical ex-situ and in-situ properties and performance and the correlation with their digital signature.

The aim of **WP6** is to facilitate the digital modelling of cause and effects relationships via the use of 'big data' mining and analysis techniques.