technology profile

# FIT-4-AMANDA: FIT FOR AUTOMATIC MANUFACTURING AND ASSEMBLY

## Ideas on utilisation

With the conundrum of fuel-cell cars and the missing infrastructure finally drawing to a close and the fuel-cell technology becoming mature, the focus shifts towards mass-manufacturing processes, which promise the lowering of price of components by increasing the produced volume. The conventional cars are manufactured in tens of millions per year and the only way to become relevant is to ramp up the production far beyond the capacity of manual labour. The automation allows much higher volumes to be attained, but necessitates compromises introduced by the machinery involved in the process and quality assurance that has to guarantee that the numerous pieces of hardware will perform to specifications.

The ambition of the Fit-4-AMandA project is to modify the current design of PEMFC stacks and stack components, and build an entirely new equipment facilitating automation of the stack assembly process (including inline non-destructive tests). Furthermore, it will demonstrate the resulting mass-produced stacks in real environment by integrating the output into a Light-Commercial-Vehicle. The project will offer the mass production machine innovative solutions, which affect process, product and tools with the objective to bring the Manufacturing Readiness Level from MRL5 (Capability to produce prototype components in a production relevant environment) to MRL7 (Capability to produce systems, subsystems or components in a production representative environment).


*Figure 1: Design of the Mass-Manufacturing Machine (MMM)*

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## Potential adopters of technology

The Fit-4-AMandA project results in two major products: a mass-manufacturing machine (see Figure 1) and a fuel-cell stack, which was redesigned and optimised for the automated manufacture. The MMM would be of interest mainly for the fuel-cell stack manufacturers that want to upscale their production volume. Typical customers for the optimised stack are, especially after the integration into a UPS' Light-Commercial-Vehicle and field-testing, delivery and logistics companies and postal services.

## Advantages of technology

In the scope of the project, an MMM with an automation grade of more than 90 % is developed, which is capable of producing ready-to-operate fuel-cell stacks in one assembly line at a theoretical throughput of >10,000 stacks/year. The technology of the MMM should reduce the production time from the current 40 hours (manual assembly) to 30 minutes per stack (automated assembly).

## Market and context of technology

Three methods of stack assembly are used depending on the production rate: manual, semi-automated, and automated. At the lowest production rate, a manual assembly is preferable. Workers are using their hands to pick and place each component of the fuel-cell stack. The stack is built sequentially at a single workstation. After the pressing and tensioning with tie rods or with compression bands, the finished stack is removed from the workstation and then subjected to testing and conditioning. Because the workers can inspect parts during the stacking, less quality-control instrumentation (e.g. optical detection system) is needed.

At higher production rates, the semi-automatic or automatic stack assembly is superior. In semi-automatic stack assembly, repetitive processes such as alternating the BPP and MEAs are automated, but the assembly of the end components (end plates, current collectors, initial cells), pressing and tensioning is performed manually. The quality control is required to ensure the reliability and performance of produced fuel-cell stacks.

## Preconditions in adopting enterprises

Majority of fuel-cell stack manufacturers are currently using a manual assembly. A transition to semi- or fully automated production requires significant investments in manufacturing development. In order to move beyond the state-of-the-art, the main targets of the Fit-4-AMandA project are the development, manufacturing and testing of technology and machine system for the automatic assembly of fuel cell stacks. The MMM is modular and therefore highly adjustable to different stack formats.

FIT-4-AMANDA

www.fit-4-amanda.eu

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