SHORT TERM SCIENTIFIC MISSION (STSM)
PUBLIC SUMMARY

Action number: CA17107
STSM title: Feasibility study of the integration of printed circuits in composites for automotive and aeronautics
STSM start and end date: 06/04/2019 to 12/04/2019
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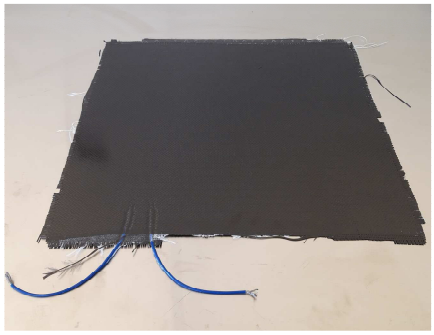
SUMMARY

The purpose of the mission was to study the feasibility of the integration of printed circuits in composites for the automotive and aeronautics applications, bringing together the experience of more than a decade in printed electronic from NAITEC and the advanced development of AMADEMA for composites preparation.



Together with this general objective, this mission persued:
1) to stablish a solid relation between NAITEC and AMADEMA as a starting point to create a strong European network between researchers and relevant stakeholders.
2) to address challenges of the automotive and aeronautics sector in terms of weight reduction, advanced functionalities and advanced manufacturing.
This mission focused on the integration of electronics on the composites in order to reduce weight, incorporate advanced functionalities and simplify the manufacturing process.
The work has been focused on the development of a functional composite demonstrator in order to study the feasility of the integration of printed circuits in composites for automotive and aeronautics.
Firstly, 4 different substrates were selected as carrier substrates of the electronic circuits: NanoWeld® produced by AMADEMA, non woven fabric similar to the veil introduce in composites, glass fiber and siliconized paper. Secondly, the electronic circuits were printed in the selected substrates at NAITEC. For that purpose a screen printing printer was used and a commercial stretchable silver ink was selected. Furthermore at AMADEMA, more than 12 composite laminas were fabricated using an in-house hand lay-up method. The 4 different printed substrates with different electronic designs were introduced in the middle of the composite laminas. The laminas were hand-made in a composite preparation table using epoxy resin. The produced composite laminas were 4 layers of woven carbon fabrics with different configurations depending on the printed substrates introduced and in some of them AMADEMA product, NanoWeld® was used. Besides, 3 different strategies for electronic connection were studied. More over, different trials were carried out in order to transfer the circuit directly to the fiber layer to avoid the “carrier” layer complitety. Different conditions for transferring the circuit from the printed siliconized paper to NanoWeld® (diferents times and temperatures) were tried by applying temperature using a heating press. Transference via ultrasonication was also tried adjusting different parameters of the equipment. The integrated printed circuits were tested with a multimeter after the composite lay up in order to see if the resin impregnation, vacuum process or curing process affects the electrical conductivity of the printed circuits.
A succesful prototype was prepared confirming the feasibility of the integration of printed electronics in composites for automotive and aeronautics.
As said before, it was proved that printed electronics can be integrated in a composite preserving its functionalities. This integration can allow, for instance, to reduce weigth drastically in automotive and aeronautics by the remplacement of conventional circuits by printed circuits on composite matrices. Moreover, this hybrid materials will permit to include order functionalities on the composites such as defrosting functions or sensors and actuators in the composites.
In addition to this experimental activities, NAITEC and AMADEMA have exchange different ideas about possible future collaborations to address challenges fot he automotive and aeronautics sector. Moreover, both institutions have identified activities to further develop the proven idea in the frame of this STSM.