

## PhD Grants from the China Scholarship Council: Co-operation Program with the UTs and INSAs (France), Program 2019

**Thesis subject :**

Elaboration and characterization of functionalized hybrid carbon fiber reinforced composites (CRFCs) for aircraft application.

**Keywords :**

CRFCs, hybridization processes, hybrid structures, delamination, functionalization

**Description :**

Since decades, carbon fiber reinforced composites (CFRC) have been successfully developed as efficient and lightweight materials for various applications and mostly for aircraft structures. Better functionalizing of these structures brings added values that contribute to new performances. Today, functionalizing composites faces a big challenge due to incompatibility issues between the matrix and the reinforcement. Developing solutions to overcome such a limitation is milestone for improving technical and usage performances of composites [1-2]. This is the major objective of this PhD works that focuses on functionalization generated by a hybrid layered structures made of CFRC composite and metallic phase. For that purpose, the research works include three significant parts.

A first part includes an experimental work for successfully manufacturing the hybrid composites. Various processes will be investigated and compared, viz. infusion, thermocompression and vacuum assisted molding. Suitability and efficiency of each of them will be thoroughly studied while considering a specific aspect: the optimization of structural hybrid cohesions in terms of materials compatibility, working conditions and process parameters [2-3].

The second work package includes analysis and characterization of the structural integrity of the hybrid composite. We will investigate the hybrid inter-layer cohesion through experimental analysis and numerical simulations. This experimental part relies on the mechanical characterization of the hydride interface behavior using various mechanical tests (dynamic impact, bending test, torsion test and tensile tests). The results will be coupled with modeling and numerical simulation to study the delamination phenomena that prevail for such hybrid composites [4]. Models of hybrid interfaces behavior will be developed for that purpose. Numerical simulation will be performed using Comsol Multiphysics and Abaqus 6.14 software packages.

The third parts will investigate the functionalization possibilities using the hybrid composites. Our objective is to develop new functions capable for improving the durability of aircrafts CRFC composite structures when they are subjected to aggressions produced by

the environments where they are used. This aspect is combined with lightweight design to keep the functionalized hybrid composite as light as possible.

**Expected background of the PhD candidate :**

Mechanics of materials, materials characterizations, process optimization, finite element simulation

**Supervision of the research works :**

Supervisor: J-C. Sagot<sup>1</sup>

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**References**

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