Evaluation of interfacial strength in a Thermoplastic Fiber Metal Laminates

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Thermoplastic Fiber Metal Laminates

Concept

Nowadays, the increasing demand for light and strong structures leads to the use of different materials at the same time. Hence, metal alloys are widely used together with fiber reinforced polymers to obtain hybrid structures suitable for several engineering applications such as nautical, aerospace and automotive.
In this context Fiber Metal Laminate (FML), play an important role, because have the advantages of high fatigue and impact resistance, low water absorption and low weight.
The usage of thermoplastic materials in a composite structure has various advantage, in fact they are easily repairable and formable, but they don't have a good chemical or mechanical interaction with reinforcement.
The aim of this studies is to evaluate how improve the interaction between thermoplastic matrix (such as PEEK, PPS, PEI), the fiber reinforcement, and the metallic substrate (Titanium or aluminum alloy).
Various treatments on the metal and polymeric substrate will be evaluated to reach the object.

Scientific approach

1. Literature studies to evidence what is present nowadays in the research field and what could be interesting.
2. Identification of the materials that could have major interest.
3. Analyzation of the chemical components of each substrate and how they can interact each other.
4. Establish which treatment on the metallic and/or reinforcement surfaces could improve the mechanical strength of the composite material.
5. Evaluate these treatments studying mechanical behavior of this kind of materials, measuring the interface strength during type I or II fracture.
6. Find how the material broke by investigating the SEM (Scanning Electron Microscope) images of the fracture surface.
7. Identify the weakest points and improve them.
8. Develop a numerical model that can simulate the behavior of these material under a certain mechanical stress, so the future changing could be applied easily.

Research objectives

The aim of this research project is to study the behavior of these materials. To define how the interface between such dissimilar materials behaves and how to improve it, various chemical investigations and treatments, that improve both the chemical and mechanical interaction, are performed. A more detailed investigation, with appropriate test methods, such as interlaminar shear strength or double cantilever beam tests, could assess in detail how the fracture pushes forward.