“Petite Immersion dans le Monde des Surfaces & Interfaces et Leurs Conséquences & Impacts dans le Quotidien de la Mise en Forme des Matériaux Composites”

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ou

"A Short Journey Around Surfaces & Interfaces and Some of Their Consequence in the Everyday Composites Forming Process Life”

« *Composite materials offer nowadays a unique opportunity for development and evolution of parts. These multi-component materials that can be defined "à la carte", can very easily be endowed with particular properties, multiple functionalities, and even gradient properties in a wide range of areas (optical, electrical,. ..), offering an incredible ratio mechanical performance on density and reaching records of temperature, chemical attacks, or corrosive environments resistance. These materials find a place in so many fields: sports and leisure, transportation (aeronautics and space, land, naval ..), civil engineering (housing, structures (eg. bridges..), but also in repairing (offshore, auto), as well as in the micro-sectors (micro-electronics, cosmetics, clothing, etc.).*

However, the only cloud on the horizon concern their manufacturing. It remains difficult today to organize a customized, robust and reliable production while controlling costs. In addition, it is difficult to master a production that unusually concentrates very varied physics, at multiple scales, which can have dramatic impacts on the quality of the parts. Moreover, at all scales of the product and at all stages of implementation, there is an omnipresent uncertainty about the quality of the material, the part and the process. All these sources add up and feed the difficulty of implementation. That is why most of the applications today remain in the fields with high added value or in reduced series, which keeps the cost very high.

In order to deal with these problems, it was used to model a well identified physic at each scale and stage of manufacture, and then to feed the models with well- defined calibration measures and procedures. It is obvious that the development and control stages of the composite parts production lines must be rethought and adapted. New markers, quantities to be measured and controlled must be identified and monitored during production. The same is true about the usual specifications of components and semi-finished products.

Indeed, composite materials being composed of several materials, have a much larger surface / volume ratio than a traditional material that we consider in bulk, so approaches in thermal, mechanical, electromagnetic domains... require to evolve and be adapted to match these new materials, manufactured by new processes.

It is in this context that the developments presented later were carried out: in order to better understand the processes, to propose a better identification of the preponderant physics, having a strong impact during the manufacturing of these materials, then to propose adapted digital simulation tools, allowing to complete the understanding and go towards mastering and optimization of the processes. »

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