

## Indicating Coatings for CFRP Composites in Aeronautics

S. Senani<sup>1</sup>, L. Rozes<sup>2</sup>, Q. Morelle<sup>2</sup>, M. Gaudon<sup>3</sup>, E. Duguet<sup>3</sup>, E. le Bourhis<sup>4,a</sup>, S. Barut<sup>1</sup>, S. Guinard<sup>1</sup>, F. Touchard<sup>4</sup> J.-F. Letard<sup>5</sup>, P.-J. Lathierre<sup>6</sup>

<sup>1</sup>Airbus Group Innovations, Suresnes, France, <sup>2</sup> Université UPMC – LCMCP, Paris, France, <sup>3</sup> ICMCB Université de Bordeaux, France, <sup>4</sup> Institut P<sup>1</sup>, Université de Poitiers, France, <sup>5</sup>OliKrom, Pessac, France, <sup>6</sup> MAPAERO Pamiers, France,

<sup>a</sup>eric.le.bourhis@univ-poitiers.fr

**Abstract.** The work reports on the development of an indicating coating for fiber-reinforced composites with polymeric matrices used in aeronautics. The challenge tackles both gaining time in inspection while proposing a solution that can be scaled up to industrial demand.

### Introduction

Because of their very light weight, excellent in-plane properties and high specific strength, fiber-reinforced composites with polymeric matrices have found many uses in structural applications [1]. A key issue in their application is the monitoring of damage induced in use. This time consuming operation represents an important cost for the consumer. Hence developing an indicating coating is required so as to gain both cost saving and reliability.

### Impact and impact detection

Fiber-reinforced composites with polymeric matrices risk damage upon use in aeronautics. Over a certain threshold, impact energy density can lead to internal damages in the composite [2]. So far, adding to the problem, such damages can be barely visible, necessitating the use of expensive and high time-consuming ultra-sonic, non-destructive inspection. Thus constant growing use of CFRP on aircraft rises up new challenges of non-destructive testing for structural parts: for example, health-monitoring methods to implement for daily inspection in FAL (Final Assembly Line) or during service life. The question arises as to how indicative coatings could answer these complex questions.

Additional “visible” detection system on composite parts will allow focusing ultra-sonic inspection only on areas required. Investigations to develop new impact-sensitive coatings, more especially based on sol-gel chemistry will be presented. On the one hand, the aim is to obtain a coating not only able to highlight the area of a part exposed above critical energy density, but also to fulfil aeronautic requirements adding severe constraints about adhesion performance or life time of the coating. In addition to setting the functionality of the materials, the challenge here is to translate properly industrial requirements to match the properties of the coatings and vice versa.

### Conclusion

Indicating coatings for fiber-reinforced composites with polymeric matrices are proposed and developed to meet aeronautics requirements. The solution here proposed will represent gains, both in terms cost saving and reliability.

### References

- [1] P. Irving and C. Soutis, *Polymer Composites in the Aerospace Industry*, Elsevier Ltd. (2014)
- [2] R. Talreja and C. Veer Singh, *Damage and Failure of Composite Materials*, Cambridge University Press (2012)