CNT-MODIFIED CARBON-FIBER-REINFORCED COMPOSITES FOR AEROSPACE APPLICATIONS

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Summary. The influence of carbon nanotubes (CNTs) on the interlaminar properties of epoxy based carbon-fiber-reinforced composites is discussed in this work. In this approach CNTs have been introduced in the dry preform, which has been subsequently infused using the Vacuum Assisted Process (VAP). Results show an increase of the fracture toughness and a decrease of the impact damages.

Carbon Fiber Reinforced Polymers (CFRPs) are increasingly used in aircraft due to their lightness combined with good mechanical properties, see Figure 1. Their stiffness and strength are particularly to be pointed out, but unfortunately CFRPs also show poor through thickness properties which make them susceptible to delamination and impact damages. As impact loads are unavoidable during service-life of an aircraft (e.g. bird strike, stones, hail impacts) and induce subsurface defects and damages which are not visible on the surface, it is of big interest to enhance the damage resistance and tolerance of these materials.

Since their discovery in 1991, Carbon Nanotubes (CNT) have attracted attention due to their extraordinary mechanical and electrical properties [1]. Although significant improvements in resin systems have been reported in literature [2], these improvements could not be translated convincingly to fiber reinforced materials. This is attributed to the different fracture mechanisms as well as the lack of suitable processing methods to infiltrate and properly place the CNTs within the fibrous composites.
In this work, we concentrate our attention on commercially available carbon nanotubes and we compared their influence on CFRP made of non-crimp fabrics and epoxy resin (RTM6) with high fibre volume content (~60 vol.-%).

A good dispersion of the CNTs in RTM6 could be achieved. However, the resulting increase of the viscosity does not allow using infusion processes for the production of CFRPs. We present a route towards the incorporation of CNTs in C-fiber materials which overcome the processing difficulties. The CNTs are introduced in the dry preform between the NCF layers and the whole assembly is then infused using the VAP process with neat resin. In this way laminates have been successfully infiltrated.

We will present the results on the mechanical performance of these CNT modified composites, in terms of fracture toughness, impact resistance and fatigue.

REFERENCES