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MATERIALS AND STRUCTURES SYMPOSIUM (C2)
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SUCCESSFUL DEVELOPMENT AND MONITORING OF CFRP MANUFACTURING TECHNOLOGIES

Abstract

Due to the request for lower weight and lower costs for future space applications, MT Aerospace (MTA) is developing forward-looking manufacturing processes for a new generation of composite pressure vessels and structural launcher components. MTA focuses on two different manufacturing technologies: On the one hand thermoplastic fiber placement and on the other hand dry fiber winding combined with automated fiber placement and subsequent resin infusion.

The thermoplastic fiber placement is based on a lay-up head equipped with a laser as heat source to melt the matrix of the laminate and the incoming tape. The local temperature distribution measured by a thermo-camera is used for the closed loop control of the laser. The focal point of the laser is followed by a consolidation roller which induces the required consolidation pressure during solidification of the thermoplastic matrix. At the end of a track the tape will be cut by the lay-up head. Thus the component is finished directly after the fiber placement process without the need of a further time consuming curing process. Due to unlimited part thickness and the resulting performance of the laminate, this technology is well suited for large pressure vessels and structural launcher components.

The measurements of the thermo-camera can also be used for an online non-destructive testing: Thereby the different heat transfer characteristics between well- and moderately consolidated laminates can be used for the indication of a potential original defect. This method is identified to be best suited for the continuous verification of the structural integrity .

The second technology uses dry fibers which are wound or placed on a mandrel using a winding machine or a lay-up head. Afterwards the resin is infused into the dry preform and cured in an oven. The advantage of this technology is that low cost raw materials can be used. Also high wall thicknesses – up to 50 mm – can be infused. Therefore the technology is highly suitable for components with a high material usage. Within the ongoing development program the necessary tooling and machinery for a pressure vessel production is developed and tested.