

Integration of NDT into the manufacturing process chain of functionalized UD-tape components

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'Function integration' has emerged as one of the more efficient lightweighting strategies in the recent times in the field of thermoplastic unidirectional tape (UD-tape) composites. However, defects may be induced at each of the process steps, altering irreversibly the final product quality. One of the effective defect tracking methods is by creating a digital representation of the manufacturing steps and quality characteristics by recording the steps through integration of suitable sensor technologies. In that regard, quality assessment during the production of complex thermoplastic UD-tape composites, using hybrid injection molding with process-integrated Non-Destructive Testing (NDT) and sensors formed the key focus of this study. Three locations in the process chain; UD-tape production, laminate stage, and final component stage, were selected for quality assessment by tracking tape. Thermography and laser systems were used to track the inconsistencies in the UD-tape production step. The collected digital defect information is used to segregate the irregularities in the material by creating cut-outs. The quality of the laminate was then evaluated using integrated eddy-current sensors and that of the final part with ultrasonic testing. The application and potential of these NDT and integrated sensors to create a holistic digital quality footprint for manufacture of highly complex function-integrated parts using thermoplastic composites are discussed in this study.