Development of a Coating Process for Continuous Fiber Reinforced Thermoplastic Composites Manufactured with T-RTM Technology

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One of the key challenges of the 21st century is recycling and sustainable waste management. A primary objective of the European Union is the establishment of a circular economy and the minimization of waste. Consequently, thermoplastic composites are receiving increasing attention due to their significant advantage over conventional thermoset counterparts: they can be efficiently recycled through material reprocessing (e.g., by grinding followed by short-fiber injection molding). [1]

In the production of continuously reinforced composites, the Thermoplastic Resin Transfer Molding (T-RTM) technology is gaining attention in the last few years. This method enables the in-situ polymerization of monomers within the mold, resulting in high-quality, well-impregnated composite structures [2]. However, a major drawback of the technology comes from the low viscosity of caprolactam (5–10 mPas), which complicates the incorporation of additives. Additives are necessary to improve the properties and resistance of the matrix. Additives tend to either settle at the bottom of the mold or being filtered by the reinforcing fabric in the mold during injection. This leads to inhomogeneous and low-quality products. [3]

A potential solution for this problem is the application of an additive-enriched coating layer that provides desired properties (e.g., UV resistance, wear resistance) that the unmodified matrix material lacks. In this study, I focused on developing such a coating process. Various coating layers were formulated and characterized. Subsequently, coated test specimens were produced, and the adhesion between the coating and the composite structure was evaluated.

Keywords: T-RTM, thermoplastic composite, coating, carbon fiber, polyamide 6

References

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