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ADAPTATION OF THE RESIN TRANSFER MOULDING (RTM) PROCESS FOR MANUFACTURING A THERMOPLASTIC-BASED COMPOSITES

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Thermoplastic-based composites (TPC) are seriously challenging thermoset-based ones (TSC) mainly due to their lower price, their recycling ability and their fracture toughness. For instance, polyamide-based parts are widely used in the automotive industry for semi-structural applications. Most of TPC are processed by compression at high pressure and high temperature. Because of the high viscosity of the polymers in the molten state, these parts are often suffering from a lack of fibres impregnation which limits their applications. An alternative way could be to manufacture TPC using reactive processes usually devoted to TSC. Among reactive processes, Resin Transfer Moulding (RTM) is a low pressure technique widely used for the manufacturing of large and/or complex parts with high fibre contents. Thermoplastics which can be synthesized from low viscosity monomers in process conditions are eligible to this technique. Among them, polyamide 6 which can be obtained from ?-caprolactam by Ring Opening Polymerization (ROP) is a possible candidate. The aim of our work is to optimize the RTM-processing of glass-fibre-reinforced composites based on polyamide 6. A chemistry adapted to industrial RTM conditions has first been selected. Among possible synthesis paths, a reactive system based on ?-caprolactam, N-acetylcaprolactam and methylmagnesium bromide (MMB) has been chosen for its relatively low sensitivities as well as its versatility. The synthesis conditions (ratios, temperature) have been studied to find a optimal. In a second part, a bi-component RTM injection machine has been designed to be adapted to the specificity of PA-6 reactive processing. Injection trials based on the lab scale results are underway on glass-fiber fabric with specific sizing. The obtained composites will be mechanically characterized. In particular, the quality of the matrix-fibre interface and thus, the mechanical performances will be studied in comparison with PA6 composites obtained by compression.