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PROCESSABILITY OF MODERN THERMOSETTING RESINS FOR LIQUID COMPOSITE MOULDING

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Currently there is a growing demand for modern thermosetting resins for the manufacture of high-performance glass or carbon fibre-reinforced composites employing liquid composite moulding (LCM) processes, such as vacuum assisted resin infusion (VARI) or resin transfer moulding (RTM / VARTM). Such materials and processes are well established for aerospace, automotive and industrial applications. For instance, VARI is employed for rotor blades of wind mills and RTM for automobile composite parts, which will definitely play a major role on weight reduction required for implementation of electric cars.

Basically, resin systems for LCM processes require a suitable low viscosity to assure the optimal impregnation of the fibres, a sufficient pot life to allow complete filling of the mould and a subsequent fast curing to reduce the overall manufacturing cycle. These requirements can be met by most commercially available systems. However, as the industry seeks for higher performance, the basic resin systems have to be modified with functional additives in order to fulfill the new needs. The incorporation of most modifiers typically negatively affects the viscosity, pot life and / or reactivity of the systems, rendering them therefore unsuitable for LCM.

This work focuses on the processability of modified resin systems for LCM manufactured fibre reinforced composites. Here, different investigations carried out at our research group will be reported. Firstly, the correlation between infusion length (which depends on resin viscosity and reactivity) and final mechanical properties is discussed. Subsequently, modified resins are presented, including for instance the use of flame retardants and toughness modifiers, required for high performance modern resins. In this study, innovative approaches in order to modify low viscosity resins without negatively influencing the processability, such as employing liquid halogen free flame retardants and in-situ polymerizable toughners, are presented.