Manufacturing cost comparison of reactive thermoplastic RTM, stamp-forming, and thermoset RTM for an automotive chassis brace

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ABSTRACT

Increasing current and future demands for weight saving in vehicles, reducing exhaust emissions and fuel usage, is driving the need for cost effective composite material processing techniques. Automotive body-in-white (BIW) structures are traditionally produced in steel due to the combined advantages of the high material stiffness and low manufacturing cost through highly automated processes. To extend the use of composite materials in BIW structures beyond niche vehicles, the cost potential of two resin transfer moulding (RTM) processes and a stamp-forming process have been examined using technical cost modelling (TCM) tools. Carbon fibre reinforcement has been used to achieve the required weight specific stiffness versus steel. The conventional epoxy thermoset system has been compared with a novel reactive PA12 system, notably in reaction to forthcoming regulations on recycling. Based upon manufacturing cells optimised for complex shapes and middle volume production, the two RTM variants and the stamp-forming process have been compared for an automotive chassis brace. Manufacturing equipment was assumed to reflect the level of investment required for an automated line. The TCM model was used to extrapolate from the current state of the art what effect changes to the reactive PA12 material system chemistry, impregnation time, and tooling technology would have on part cost. Implementation of any such material system would have wide ranging effects on the automotive supply chain, and this is illustrated with a discussion of dedicated and utilisation based part costs and the strategic issues involved with such an implementation step.

Keywords: Resin transfer moulding, reactive thermoplastics, stamp-forming, cost modelling