Forming experiments and simulations for discontinuous fiber reinforced CF-SMC components

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Abstract. Materials with significantly different thermomechanical properties and processability are frequently used both as alternatives and as competitors for demanding LW applications. These materials reveal different microstructures and a very wide range of structure-property-performance relationships. The structure originates from the specific processing, hence, it is of prime practical and theoretical importance to predict these microstructure features and relationships for prognosticating the service behavior of the specific components. In the first part of the lecture a brief overview will be given about solid state forming of continuous fiber reinforced composites with thermoset (CFRP) and thermoplastic matrix (organosheets and TPC) and about the processing of discontinuous fiber reinforced composites (injection molded SFRP and compression molded CF-SMC). The overview involves the typical processing and simulation methods along with the material parameters necessary for these materials. To demonstrate these methods, use cases for draping simulation of CFRP and for thermoforming simulations of organosheets (2D fabrics) and for TPC (UD tapes) will be briefly introduced. A more detailed description of the methodology for designing and producing discontinuous fiber reinforced compression molded CF-SMC components on different complexity scales with particular focus on the determination of proper parameters for process and component performance simulations is provided in the second part of the lecture. Finally, a perspective to improve above engineering methodologies towards a fully integrated Life Cycle Analysis (LCA) of these materials within the integrated simulation methodology is introduced.