

Large-Scale Production of High-Performance Fiber-Metal-Laminates by Prepreg-Press-Technology

Authors : Christian Lauter, Corin Reuter, Shuang Wu, Thomas Troester

Abstract : Lightweight construction became more and more important over the last decades in several applications, e.g. in the automotive or aircraft sector. This is the result of economic and ecological constraints on the one hand and increasing safety and comfort requirements on the other hand. In the field of lightweight design, different approaches are used due to specific requirements towards the technical systems. The use of endless carbon fiber reinforced plastics (CFRP) offers the largest weight saving potential of sometimes more than 50% compared to conventional metal-constructions. However, there are very limited industrial applications because of the cost-intensive manufacturing of the fibers and production technologies. Other disadvantages of pure CFRP-structures affect the quality control or the damage resistance. One approach to meet these challenges is hybrid materials. This means CFRP and sheet metal are combined on a material level. Therefore, new opportunities for innovative process routes are realizable. Hybrid lightweight design results in lower costs due to an optimized material utilization and the possibility to integrate the structures in already existing production processes of automobile manufacturers. In recent and current research, the advantages of two-layered hybrid materials have been pointed out, i.e. the possibility to realize structures with tailored mechanical properties or to divide the curing cycle of the epoxy resin into two steps. Current research work at the Chair for Automotive Lightweight Design (LiA) at the Paderborn University focusses on production processes for fiber-metal-laminates. The aim of this work is the development and qualification of a large-scale production process for high-performance fiber-metal-laminates (FML) for industrial applications in the automotive or aircraft sector. Therefore, the prepreg-press-technology is used, in which pre-impregnated carbon fibers and sheet metals are formed and cured in a closed, heated mold. The investigations focus e.g. on the realization of short process chains and cycle times, on the reduction of time-consuming manual process steps, and the reduction of material costs. This paper gives an overview over the considerable steps of the production process in the beginning. Afterwards experimental results are discussed. This part concentrates on the influence of different process parameters on the mechanical properties, the laminate quality and the identification of process limits. Concluding the advantages of this technology compared to conventional FML-production-processes and other lightweight design approaches are carried out.

Keywords : composite material, fiber-metal-laminate, lightweight construction, prepreg-press-technology, large-series production

Conference Title : ICAMEST 2016 : International Conference on Advanced Mechanical Engineering and Spacecraft Technologies

Conference Location : London, United Kingdom

Conference Dates : May 23-24, 2016