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RESIN SPRAY PREPREGGING – HIGH VOLUME CAPABLE MANUFACTURING PROCESS FOR STRUCTURAL COMPOSITE PARTS WITH POLYURETHANE MATRIX

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Continuous fibre reinforced plastics (FRP) offer a high lightweight potential. One challenge to reduce the actually high costs of these materials is the development of new process chains for automated manufacturing of structural parts made of FRP in cycle times below 10 minutes. A new approach, which shows a high potential to face this challenge is the Resin Spray Prepregging (RSP)-process.

The RSP-process is divided into an impregnation and a forming and compression process. For the impregnation, a non-foaming polyurethane matrix is applied on a net-shape preform. Therefore the preform is fixed on a special handling device, which is mounted on a 6-axis-robot. For the planar application of the matrix, the preform is moved below a spray nozzle using a special spray pattern. This enables a fast impregnation of the preform in an automated process. To achieve the full lightweight capabilities, the fibre volume content of the impregnated preform has to be increased to about 50 % by extracting surplus resin. To realize a raise of the fibre volume content the impregnated preform is placed in a hot compression mould with an auxiliary cavity. The volume of the auxiliary cavity can be adjusted by a velocity- or force-controlled slider. This facilitates the generation of a defined profile of the hydrostatic pressure in the resin and thereby the reduction of the porosity.

This paper describes results of a process analysis of the RSP-process. For the analysis of the spraying process, a new measurement technique has been developed to characterize the impregnation. The results show a relation between spraying parameters and preform impregnation. Furthermore results of manufacturing studies to investigate the resulting laminate quality and the achievable cycle times will be presented. High quality laminates with fibre volume contents of over 50 % can be manufactured in cycle times of 6 minutes.