

Friction Stir Welding of Light Weight Sandwich Materials

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Abstract. Ever since its invention, friction stir welding has been of great interest for the joining of light weight materials. Due to joining in the solid state, friction stir welding inheres characteristic advantages that are unmatched by conventional fusion welding techniques. At the Chair of Manufacturing Technology friction stir welding is employed to develop a process chain for the production of highly load adapted car body components out of aluminum sheet metal and aluminum foam sandwich (AFS) by tailored blanking. In contrast to friction stir welding other materials, special measures have to be taken, since AFS comprises a layered material structure out of two solid aluminum sheet metal cover layers and a powder metallurgically produced core layer. After welding, the tailored blank is subjected to forming, foaming and a final laser cutting process. High temperature capability of the weld seam must be assured, hence foaming of the powder metallurgic core layer requires temperatures of up to 95% of core layer-solidus temperature. Therefore not only mechanical properties are revealed, but also temperature capability is assessed by differential scanning calorimetry (DSC). Additionally the weld seams are tested during foaming by the use of special specimen geometry.

Due to the high deformation and temperature while welding and foaming, the metallurgical structure at the weld seam undergoes some modifications, which are subject to metallographic analysis and hardness testing. As an outlook, new material developments towards 6000 aluminum alloys as cover sheet materials will be discussed with regard to the process chain.