

FDS process investigation: underpinning physical mechanisms, parameter operating range and numerical simulation

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Abstract. Flow drill screw (FDS) driving is a recent assembly process developed in the context of multi-material car body assembly where spot welding cannot be applied any longer. The combination of flow drilling, tapping and torque screwing into a single operation, along with the conversion of the corresponding tool into a consumable component, increase the criticality of the FDS process far beyond that of each of its individual steps. This contribution reports a rigorous study of the operating range of the FDS process parameters and their influence on the major outputs of the process. Aluminum and AHSS steel sheets are tested, separately and combined, in order to assess the influence of the material pair on the optimal process parameter set. The experimental investigation was supported by numerical simulation. A realistic model of the entire process was built, with a focus on the flow drilling operation. The numerical analysis revealed the temperature, strain and strain rate ranges involved in the process, which will further serve for mode detailed material parameter identification.