Numerical mapping of joining zone damage on hybrid components during a forming process

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Abstract. During the forming of joined hybrid semi-finished workpieces, it is important to know the maximum stresses, which can be withstand by the joining zone before undergoing a failure. The simulation based design of the forming process of pre-joined materials, requires a modeling approach with a description of the joining zone behavior. This paper presents an experimental-numerical method, which can lead to prediction of damage as well as failure of joining zones in hybrid semi-finished products during deformation. In order to determine the critical stresses at the joining zone, tensile and compression tests are performed on specimens with joining zones aligned at different angles with respect to the load direction. On the basis of these characterisation tests, the damage of the joining zone is physically mapped under various real combinations of tensile (or compression) and shear loads. The test evaluation is carried out numerically in order to determine the respective critical stress spectrum of the joining zone. Subsequently, these results are implemented in a commercial simulation program by means of user routine to design an extrusion process under consideration of the joining zone failure.