

Geometric and corrosive influences on load bearing capacity of multi-element shear-clinching specimen

Daxin Han^{1, a)}, Sebastian Wiesenmayer^{2, b)}, Marion Merklein^{2, c)}, Gerson Meschut^{1, d)}

¹Laboratory for Material and Joining Technology, Paderborn University, Paderborn, Germany

²Institute of Manufacturing Technology, Friedrich Alexander University Erlangen-Nuremberg, Erlangen, Germany

^{a)}Corresponding author: daxin.han@lwf.upb.de

^{b)}sebastian.wiesenmayer@fau.de

^{c)}marion.merklein@fau.de

^{d)}meschut@lwf.upb.de

Abstract. The trend of multi-material design in car body construction carries new challenges for joining technology. To ensure the joining of similar or dissimilar metal sheets, mechanical joining technologies offer great possibilities for fastening varied materials without thermal influences and strict requirements on the surface. Clinching is an established process for joining diverse metal sheets or profiles without using auxiliary elements. Conventional clinching is often limited by the ductility of the joined materials. The newly developed shear-clinching technology is characterised by combining indirect cutting and clinching in a pre-hole into one stage, which extends the process boundary up to a tensile strength of 1500 MPa. Yet, a definition of the application of shear-clinching technologies needs to research some possible influences on the load bearing capacity of multi-element specimens. The influences in the experimental investigation are divided into the geometry of the specimen and the corrosion phenomenon. The 8-element specimens were joined with varied point distances in the shape of a single lap shear load specimen and different overlaps in the form of an LWF-KS2.5 specimen. Afterwards, the multi-element specimens were segmented into one-element specimens, which were tested under quasistatic shear load and cross tensile load in order to detect possible influences of the specimen geometry. The effect of corrosion on the load bearing capacity was investigated with a 8-element specimen in the form of single lap shear load specimen according to VDA 621-415. In addition, an arrangement of corrosion protection was generated in order to guarantee the joint quality in a corrosive surrounding atmosphere. It was found that the load bearing capacity of specimens as well as the joint characteristics can be ensured using corrosion protection. The study gave a recommendation for planning the shear-clinching on a flange facing and showed promising potential for shear-clinching when joining multi-element specimens.