Flux-Less Joining Technique of Aluminium with Zinc-Coated Steel Sheets by a Dual-Spot-Laser Beam

H. Laukant[1,a], C. Wallmann[1,b], M. Korte[2,c] and U. Glatzel[1,d]

[1]University of Bayreuth, Metals and Alloys, Ludwig-Thoma-Str. 36b, D-95440 Bayreuth, Germany

[2]Audi AG, I/EG3, D-85045 Ingolstadt, Germany

[a]Holger.Laukant@uni-bayreuth.de, [b]Clemens.Wallmann@uni-bayreuth.de,
[c]Michael.Korte@audi.de, [d]Uwe.Glatzel@uni-bayreuth.de

Keywords: laser, aluminium, steel

Abstract. Joining of iron with aluminium in the liquid phase is complicated due to the formation of brittle intermetallics within Fe-Al melts. In this work we present the technology of a laser welding-brazing (LWB) process to join zinc-coated steel and aluminium sheets in an overlap geometry.

The process is divided into welding of the aluminium sheet and brazing of filler material and molten aluminium sheet onto the zinc-covered steel sheet to avoid the liquid stage of iron. It is possible to join those materials with a single laser beam. However, with a second laser beam, the melt flow can be controlled more effectively and the wetting behaviour can be improved by preheating the zinc-covered steel sheet surface. This is beneficial since the process works without any flux agent. Wetting lengths increase by using this technique and generate a joint that exceeds the tensile strength of the base material.

Due to the zinc cover on the steel sheet there are two possible filler materials that have miscibility with zinc as well as aluminium. Zinc based filler materials have the advantage of a lower melting point and thus lower process temperatures. And aluminium based filler wires result in more ductile brazed seams, making it possible to deform such joints in a later application as tailored blanks.