Improving the Mechanical Properties of Laser-Welded Hybrid Workpieces by Deformation Processing

B.-A. Behrens[1)]; A. Amiri[2)]; D. Duran[1, a)]; S. Nothdurft[3];
S. Kaierle[3]; H. Ohrdes[4]; J. Wallaschek[4], T. Hassel[5]

[1]*Institute of Forming Technology and Machines, Leibniz Universität Hannover, An der Universität 2, 30823 Garbsen, Germany*

[2]*Department of Mechanical Engineering, Islamic Azad University-North Tehran Branch, Tehran, Iran*

[3]*Laser Zentrum Hannover e.V., Hollerithallee 8, 30419 Hannover, Germany*

[4]*Institute of Dynamics and Vibration Research, Leibniz Universität Hannover, Appelstraße 11, 30167 Hannover, Germany*

[5]*Institute of Materials Science, Leibniz Universität Hannover, An der Universität 2, 30823 Garbsen, Germany*

[a)]Corresponding author: duran@ifum.uni-hannover.de

Abstract. Today's competitive manufacturing world needs machine components with superior quality, cheaper price and lighter weight. Although manufacturing components by welding different metals is one of the common ways to achieve the above-mentioned goals, the welding process may have some downsides to the quality of the component. "Tailored Forming" is a novel processing concept in which hybrid workpieces are fabricated by welding different metals and then subjected to deformation processing at elevated temperatures. The combination of plastic straining during forming and high temperatures leads to the activation of recovery and recrystallization processes which improve the mechanical properties of the component by replacing the directional and coarse microstructure of the weld metal with an equiaxed and fine microstructure after forging. The hybrid forging billets used in this study combine alloy steel (41Cr4) with plain carbon steel (C22.8) and are manufactured by laser welding. An experimental test matrix is employed which utilises variations of process parameters with the intention of influencing the geometry and the microstructure of the materials' joining zone. The effects of the deformation processing of laser-welded hybrid workpieces are characterised by destructive testing and metallography.