# Investigation into the Bond Strength of the Joining Zone of Compound Forged Hybrid Aluminium-Steel Bearing Bushing

Valeria Sokolinskaja[1, a)], Anna Chugreeva[1, b)], Julian Diefenbach[1, c)] and Bernd-Arno Behrens[1, d)]

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

[a)]*Corresponding author: vsokolinskaja@ifum.uni-hannover.de*
[b)]*chugreeva@ifum.uni-hannover.de*
[c)]*diefenbach@ifum.uni-hannover.de*
[d)]*behrens@ifum.uni-hannover.de*

**Abstract.** The proper application of multi-material design is an effective way of saving energy costs and reducing $CO_2$-emissions. In the production of heavy-duty components, the tailored forming technology offers the possibility of bringing the right material to the right place. In this context, this paper deals with the challenges that arise during compound forging such components using the example of a bi-metal bearing bushing. For this purpose, steel is placed into the highly stressed bearing surface, where high performance characteristics are required, while the rest of the part is made of aluminium to reduce the total weight of the component. Due to the different material properties of steel and aluminium, the process design for bi-metal compound forging is very demanding and requires process-specific heating and forming strategies, which are presented and discussed in this paper. After the implementation, forging experiments were carried out and the bearing bushings obtained were evaluated by metallurgical and mechanical tests. A crucial aspect in assessing the quality of such components is the bond strength, which generally depends on the development of intermetallic phases. Therefore, an analysis of the phase formation in the area of the joining zone of the compound forged parts was performed initially using optical microscopy, scanning electron microscopy (SEM) and energy dispersive spectroscopy (EDS) analysis. The metallurgical studies showed good bonding with form- and force-closed joint and insular intermetallic phases along the joining zone. Afterwards, the bond strength was determined by push-out tests, whose results were finally correlated with the metallurgical findings.