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Upsetting of Tri-Metallic St-Cu-Al and St-Cu60Zn-Al Cylindrical Billets

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Abstract : This work investigates upsetting of the tri-metallic cylindrical billets both experimentally and analytically with a reduction ratio 30%. Steel, brass, and copper are used for the outer and outmost rings and aluminum for the inner core. Two different models have been designed to show material flow and the cavity took place over the two interfaces during forming after this reduction ratio. Each model has an outmost ring material as steel. Model 1 has an outer ring between the outmost ring and the solid core material as copper and Model 2 has a material as brass. Solid core is aluminum for each model. Billets were upset in press machine by using parallel flat dies. Upsetting load was recorded and compared for models and single billets. To extend the tests and compare with experimental procedure to a wider range of inner core and outer ring geometries, finite element model was performed. ABAQUS software was used for the simulations. The aim is to show how contact between outmost ring, outer ring and the inner core are carried on throughout the upsetting process. Results have shown that, with changing in height, between outmost ring, outer ring and inner core, the Model 1 and Model 2 had very good interaction, and the contact surfaces of models had various interface behaviour. It is also observed that tri-metallic materials have lower weight but better mechanical properties than single materials. This can give an idea for using and producing these new materials for different purposes.

Keywords : tri-metallic, upsetting, copper, brass, steel, aluminum
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