

Heat Treatment and Mechanical Properties of 70-30 Brass Processed

by Deep Drawing

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Abstract

The primary purpose of this work is to create a Finite Element Model and conduct an experimental investigation of the evolution of the microstructure and mechanical properties of the 70/30 Brass during production processes of brass cartridge cases in order to measure and simulate the material behaviour during forming process. The investigated forming process, which consists of a series of drawing, annealing and other finishing processes, is considered as one of the most advanced technologies in mechanical engineering because it permits the production of a large number of products in a short amount of time while maximizing the use of raw materials. The starting materials in this study, in the form of 70/30 Brass drawn cups, were sourced from two different suppliers. The evolution of microstructure and mechanical properties of the material was studied through chemical and mechanical characterization at different stages of processing. The drawing process which is the main forming process was modelled geometrically and computationally using the commercial finite element method (FEM) package ABAQUS. ABAQUS is well known for effective modelling of cold and hot forming processes of metallic materials. The purpose of the numerical simulation was to determine the deformation changes in the semi-product material after each drawing step, with a focus on the changes in dimensions and regions with the highest amount of plastic deformation. The FEM model was successfully able to predict the dimensional changes after each drawing steps. Moreover, the predicted distribution of plastic deformation after the final drawing step was consistent with the hardness variation along the wall of drawn cans. Another important finding of this study was the effect of the composition, microstructure and mechanical properties of the starting materials on the properties of the final products despite the extensive and severe thermomechanical processing. Therefore, a comprehensive characterization of the starting materials should be carried out to avoid failures and defects during or post processing and to ensure that the final products meet the specifications.

Keywords: 70/30 Brass, Cartridge, Drawing, Annealing, Finite Elements Methods