STUDY OF THE EFFECT OF PROCESS PARAMETERS ON THE PROPERTIES OF A FORGED PART IN ALUMINUM ALLOY

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1 Introduction

Despite unique features of Aluminum alloys, such as high strength, light weight, good corrosion resistance, their mechanical and physical properties still need to be improved for using in critical applications like aerospace application, where parts can be highly stressed during exercise. Wheels and brakes for aerospace application are generally considered highly stresses application where also high temperature, because of friction during landing can occur. The work has been carried out in the framework of an industrial PhD programme between unipg and Fucine Umbre.

Aim

Improvement of mechanical properties and microstructure of 2014 aluminum alloy piston housing for aerospace application by performing a severe plastic deformation method, called multidirectional forging, and heat treatment is the aim of this research. The effects of different multidirectional deformation on mechanical properties and microstructure of the alloy has been studied. Multidirectional deformation has been simulated by FEM and provided process parameters to be used on experimental tests.

2 Methods

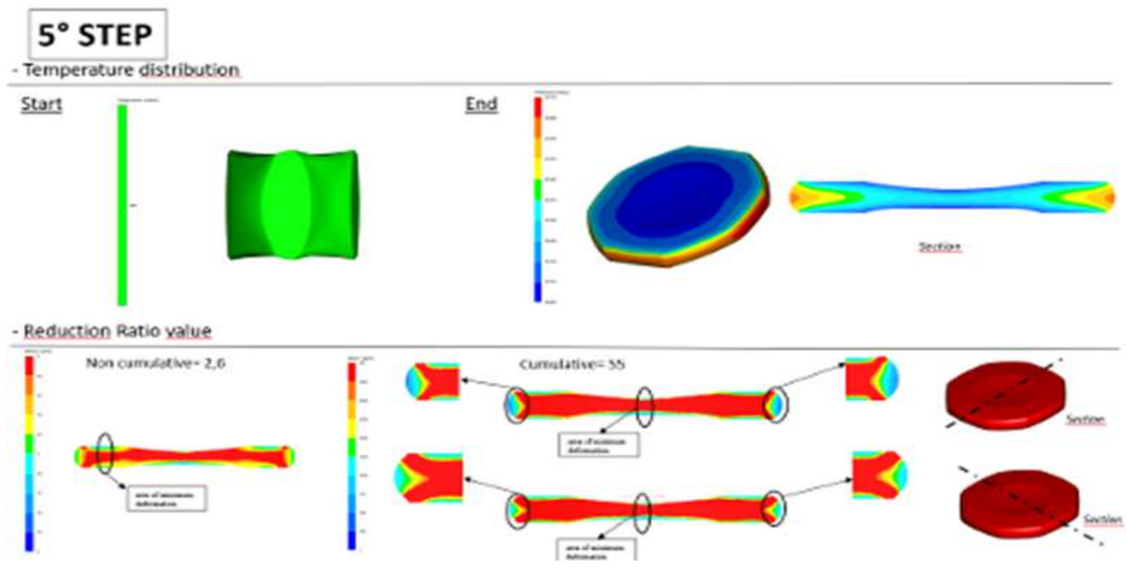
Forging process is the production process that starts from bars which are then cut into pieces of different sizes according to the geometry of the piece to be forged; the pieces are kept in the oven until the forging temperature is reached (between 350 ° C and 450 ° C for the different aluminum alloys) and then placed on presses or hammers.

During hot plastic deformation process, the phenomenon of the formation of "Grain Flow" - "Fiber Flow" - or the orientation / elongation of the 'grains' of material occurs a preferential direction, which is the one imparted by the production process itself, contributing to the refinement of the grain through a "recrystallization".

In particular, the “grain-flow” is an intrinsic characteristic of the metal components obtained by hot plastic deformation and which contributes to determining the final strength characteristics. In the direction of the "grain flow", in particular, there is an improvement of the mechanical characteristics of the dynamic type, that is the fatigue resistance.

3 Results

For each single step, the forging ratio was calculated as the average value of the analyzed section. The cumulative forging ratio is the sum of the average values of each individual step.
Increased forging ratio provided increased and homogenues mechanical properties on final component.



4 Conclusions

Multidirectional deformation has been simulated by FEM and provided process parameters to be used on experimental tests. It is a process that involves several processing steps, each with the aim of reaching a certain size, thanks to which we obtained a more uniform metallographic structure of the material than the conventional techniques in use, hence an improvement in tensile properties static and fatigue.

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