

Effect of Structure on Properties of Incrementally Formed Titanium Alloy Sheets

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Abstract : Asymmetric incremental sheet forming (AISF) could significantly reduce costs incurred by the fabrication of complex industrial components with a minimal environmental impact. The AISF experiments were carried out on commercially pure titanium (Ti-Gr2), Timetal (15-3-3-3) alloy, and Ti-6Al-4V (Ti-Gr5) alloy. A special testing geometry was used to characterize the titanium alloys properties from the point of view of the forming zone and titanium structure effect. The structure and properties of the materials were assessed by means of metallographic analyses and microhardness measurements. The highest differences in the parameters assessed as a function of the sampling zone were observed in the case of alpha-phase Ti-Gr2 at the expense of the most substantial sheet thinning occurrence. A springback causes a smaller stored deformation in Timetal (β alloy) resulting in less pronounced microstructure refinement and microhardness increase. Ti-6Al-4V alloy exhibited early failure due to its poor formability at ambient temperature.

Keywords : incremental forming, metallography, hardness, titanium alloys

Conference Title : ICAMAME 2014 : International Conference on Aerospace, Mechanical, Automotive and Materials Engineering

Conference Location : Barcelona, Spain

Conference Dates : February 27-28, 2014