World Academy of Science, Engineering and Technology
International Journal of Mechanical and Industrial Engineering
Vol:11, No:04, 2017

Perforation Analysis of the Aluminum Alloy Sheets Subjected to High Rate of Loading and Heated Using Thermal Chamber: Experimental and Numerical Approach

Authors : A. Bendarma, T. Jankowiak, A. Rusinek, T. Lodygowski, M. Klósak, S. Bouslikhane

Abstract : The analysis of the mechanical characteristics and dynamic behavior of aluminum alloy sheet due to perforation tests based on the experimental tests coupled with the numerical simulation is presented. The impact problems (penetration and perforation) of the metallic plates have been of interest for a long time. Experimental, analytical as well as numerical studies have been carried out to analyze in details the perforation process. Based on these approaches, the ballistic properties of the material have been studied. The initial and residual velocities laser sensor is used during experiments to obtain the ballistic curve and the ballistic limit. The energy balance is also reported together with the energy absorbed by the aluminum including the ballistic curve and ballistic limit. The high speed camera helps to estimate the failure time and to calculate the impact force. A wide range of initial impact velocities from 40 up to 180 m/s has been covered during the tests. The mass of the conical nose shaped projectile is 28 g, its diameter is 12 mm, and the thickness of the aluminum sheet is equal to 1.0 mm. The ABAQUS/Explicit finite element code has been used to simulate the perforation processes. The comparison of the ballistic curve was obtained numerically and was verified experimentally, and the failure patterns are presented using the optimal mesh densities which provide the stability of the results. A good agreement of the numerical and experimental results is observed.

Keywords : aluminum alloy, ballistic behavior, failure criterion, numerical simulation
Conference Title : ICME 2017 : International Conference on Mechanical Engineering
Conference Location : Boston, United States
Conference Dates : April 24-25, 2017