Review Article

A Review on Explosive forming Process

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Abstract

This paper deals with study of explosive forming processes for making sphere of very thin metallic sheets Explosive Forming is a manufacturing technique that uses explosions to force the metal into dies and moulds. The explosives are either in direct contact with the materials or detonated underwater. This process is useful for short production runs of conventionally difficult-to-manufacture parts. Explosive forming is one of the non-traditional method, in which, most commonly, the water is used as the pressure transmission medium. In this paper, we are reviewing the researches done by various authors on explosive forming process for different materials.

Introduction

Explosive forming, is different from conventional forming in this the punch or diaphragm is replaced by an explosive charge. Explosives that are used generally high -gaseous mixtures, explosive chemicals or propellants. There are two techniques of high-explosive forming the contact technique and: stand-off technique.

Standoff Technique

The work piece blank is clamped over a die and the assembly is putted into a water filled tank. Air in the die is pumped out and the explosive charge is placed at some predetermined distance from the work piece, by detonation of the explosive, a pressure pulse is produced which is of very high intensity. Also gas bubble is produced which first expands spherically and then collapses. When the pressure pulse strikes against the work piece, the metal gets deformed into the die with a high velocity of about 120 m/s.

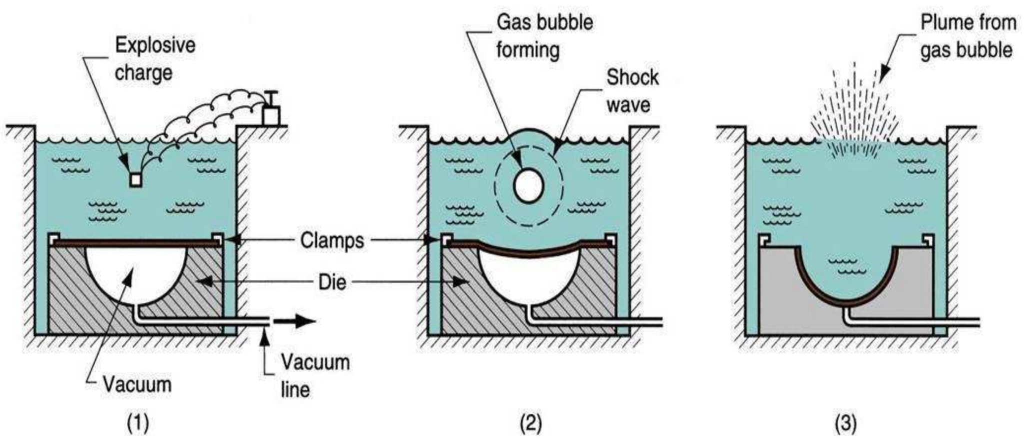

Figure 1.Stand-off technique

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The process has been successfully used to form steel plates 25mm thick x 4m diameter.

Contact Technique

The explosive charge in the form of cartridge is held in direct contact with the work piece while the detonation is initiated. The detonation builds up at extremely very high pressures (up-to 30,000MPa) on the surface of the work piece resulting in fracture and metal deformation. The process is used for the bulging tubes.

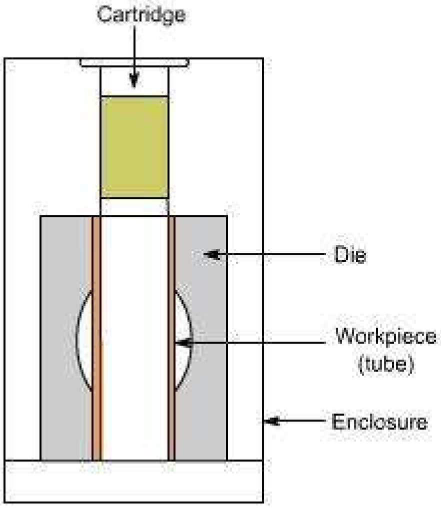

Figure 2.contact technique of explosive forming

1. Detailed literature investigation has been carried out on the following topics.
2. Effects of Shock Wave Propagation on Explosive Forming.
3. Explosive forming of thin-wall semi-spherical parts.
4. Experimental and numerical analyses of explosive free forming.
5. Non-die explosive forming of spherical vessel technology.
6. Precision control of explosive forming for metallic decorated spheres.

Literature review

Hirofumi Iyama et al [1] were studied the effect of pressure vessel for explosive forming and clarify the under-water shockwave propagation inside the pressure vessel and effect of the deformation process of the metal plate by the shock wave. for understand the effect of the pressure vessel on the deformation of the plate, numerical simulation was done. When numerical simulation performed. Three cases pressure vessel were picked up. Case(a) is cylindrical-shaped vessel and Case(b) is parabolic-shaped vessel Case(c) is hyperbolic-shaped vessel. The calculation are carried out to calculate The pressure from the explosion, the equivalent stress and strain of copper plate by using ALE equation, JWL (john-wilkins-lee) equation, Johnson cooks equation. they found the shock wave propagation produced are different depend upon shape of the pressure vessel.

S.A.A. Akbari Mousavi et al [2] they analysed explosive forming of blank metal and these analyses helps to predict parameters of the process and to remove most of the error work. They presented explosive free forming simulation of circular aluminium blank. To describe the behaviour of the blank Johnson cook and Zerilli-Armstrong equation are used. These explicit analyses were used for the simulation they simulate the explosive charge with the size of 12.16kg and ratio L/D=0.17 and compared with experimental test. the maximum deformation of the middle point measured in the simulation was 11.6cm where as in the experiment it was 119.3cm and therefore they found simulation results have the good compatibility and could be safely deduce the experiment.

Masahiro Fujita et al [3] in 1990 Non die explosive forming as spherical technology was first presented. The arbitrary Lagrange-Eulerian method was used for the comparison of three structure design of cone. The cone was three, four and six cone structure was taken which was made of SUS304 stainless steel. It was converted into three sphere by using welding. Then the explosive was used and deformed in spherical shell.in this it was found the radical velocities are not higher but moving longer duration compared to the mid-point of weld region. But it was found that cone structure was not expanded spherical perfect shape.

He Fangmen et al [4] investigated the forming method of thin spherical parts. And they found that non-die explosive forming is best suited for manufacturing of such spherical parts as it was better in achieving those results which were impossible by using the conventional machines. Non-die explosive forming was showing good forming results with high dimensional accuracy and simplicity They conducted the experiment and found that the special forming technology is good with having vast application of processing the semi spherical parts. Z Tong et al [5] analysed the forming process for metallic decorating spheres. By using the data analysis and the experimental research, they found that the advance non explosive forming method is most effective for producing such thin metallic spheres. They conducted the number of experiments using the sphere of material Q235 steel sheet with diameter 2000mm and of surface area as 12.59 m^2 with thickness of 3mm and after explosion deformation of shell took place but no wrinkles were found on the outer surface of sphere. And the maximum and minimum diameter achieved was 2001.2mm and 1998.5mmand they found the non-sphere error less than 0.2%.

References

1. Hirofumi Lyama, yoshikazu Higa, and shigeru Itoh, "Study on the effect on the shock wave propagation on Explosive Forming" *Materials Science Forum* Vol. 767 (2014) pp 132-137.
2. S.A.A. Akbari Mousavi, M. Riahi, A. Hagh Parast, "Experimental and analyses of explosive free forming" *Journal of material processing technology* 187-188 (2007) 512-516.
3. Rui Zhang, Hirofumi Jyama, Masahiro Fujita, Tei-Sheng Zhang, "Optimum structure design method for non-die explosive forming of spherical vessel technology" *journal of materials processing technolog*y 85 (1999) 217-219.
4. He Fengman, Tong Zheng, Wang Ning, Hu Zhiyong, "Explosive forming of thin-wall semi-spherical parts" *Materials Letter* 45 (2000) 133-137.
5. Z. Tong, Z. Li, B. Cheng, R. Zhang "precision control of explosive forming for metallic decorating sphere Jornal of materials technology 203 (2008) 449-453.

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