OVERVIEW OF ELASTIC RECOVERY EFFECT IN SEAMLESS PIPES

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ABSTRACT

Different shapes and size and sectional pipes form an important part of Indian Seamless pipe market. The study work brings out the difficulty of elastic recovery effect on sectional seamless steel pipes faced in manufacturing. The work will perform the analysis & modification to be done on land width of Die in controlling the spring back of sectional seamless steel pipes. The work also includes the quality declaration trials taken during the manufacturing of sectional seamless steel pipes. This yashashree tubes and pipes pvt.ltd is focused in manufacture of the continuous pipes. It Manufactures tubes for most expanded solicitations like domestic and export uses, e.g. Auto axles, basic systems, Profitable Vehicles, Two-Three Wheelers, Bearings, Oil industry, Petrochemical Industry, Refineries, Fertilizer plant, Boilers, Heat Exchangers, Pressure vessel, Hydraulic and Pneumatic Cylinders, etc .It also exports the continuous pipes to, Europe, Gulf countries etc. The plant is devised for manufacturing of seamless pipes from input round bars or ingots, various rolling mills are mounted to produce seamless pipe in hot and cold condition. Pipes made by linking together the ends of a flat strip are known as welded pipes. Seamless tubes manufactured by hollowing out solid heated billets in a blanking mill and then cold drawing process continued. Cold drawing is the process of reducing the dimensions of sectional pipes as per required size. Both the tension & compression acts on the pipes. So required thickness of pipe is achieved.

Keyword: - *Expansion,, and elastic recovery,*

1. INTRODUCTION

The pipes are mostly seen as connection together the flat strip by welding. Continuous pipes are without weld. The pipe and tubes can be seamless or with seam. Pipes with seam are producer with various welding methods. Seamless pipes are made by Extrusion or blanking and hot rolling processes, often are cold finished by drawing. Cold drawing is used to obtained closer dimensional accuracy, to produce best surface polishes , to produce pipes with thinner walls or smaller diameters that can be obtain with hot-forming methods, and to produced pipes of irregular shapes such as Round, rectangular square, hexagonal and other shapes up to 12mm crosswise or in diameter. The raw material used for production seamless pipes are different types of steel i.e. carbon steel and alloy steel. Seamless pipes are used in both low and high

temperature application. e.g. refrigeration, boilers, and transporting fluids and gas. Seamless pipe find application in high pressure hydraulic cylinders, drilling deep bores etc. several locomotive components like truck axels, bearings, steering columns, pneumatic cylinders etc are made out of seamless pipes. [1, 2]

2. LITRATURE SURVEY

Ramanan Kartik (**1995)** worked on computer aided design of dies for cold drawing. The objective of this work was to develop a CAD system that would design dies and mandrels for the cold drawing of sections of various shapes from round tubes. The system would have the capability to determine the proper hot-rolled tube size from the required cold drawn shape, thereby controlling the total reduction in area and reducing the number of passes involved in the drawing. Based on the process and product parameters, the system would calculate the drawing force requirements and stress-strain data for the work piece. [3].

Kamaruzuman bin lias (2001) studied the use of ANSYS as finite element software for analyzing the behavior of flow patterns of material, force and speed of sliding under the plastic deformation state in the drawing process. [4].

Laila S.Bayoumi (2001) obtained an analytical solution for the problem of cold drawing through flat idle rolls of regular polygonal metal tubular sections from round tube. This solution is based on obtaining a compatible velocity field that satisfies kinematic conditions to yield the strain-rate components.[5]

K.swiatkowski (2004) focused on the method of drawing with the floating plug because it allows the manufacturing of very long tubes. For thin wall small sized tubes the drum-drawing process was very popular. The additional advantage of this process was the possibility of using a very high velocity of drawing and the ability to achieve a very high productivity. [6]

P. Tiernan, M.T. Hillery et al. (2005) reports on an experimental and finite element analysis (FEA) of the cold extrusion of high-grade (AA1100) aluminum. The influence of die angle, reduction ratio and die land on the extrusion force during the extrusion process was investigated. The FEA simulation was carried out using ELFEN, FEA software, specifically produced for metal forming simulation. Axis symmetrical 2D geometric model of the tooling and billet was constructed for the analysis. Data obtained from the FE model included die-work piece contact pressure, effective stress and strain and material deformation velocity. The correlation between the experimental, calculated and FEA data obtained in this research was presented and discussed. [7]

E.M. Rubio (2006) applied analytical methods application to the study of tube drawing processes with fixed conical inner plug was presented by this paper analyses the thin-walled tube drawing processes made in conical converging dies with fixed inner plugs method.[8]

Takashi kuboki, kaigo nishida et al. (2008) find out the effect of a plug on residual stress in tube drawing. He examined both numerical analysis and laboratory experiment. The numerical analysis done by finite element method which was applied to study the residual stress in tube drawing both with and without

plug. It is concluded from numerical analysis that there was a minimum bare geometric reduction of 6% which was effective for leveling the residual stress. [9]

3. OPERATING PRINCIPLE

Maciej Pietryzyk and Lucjan Sadok shows that finite element model can be used for simulation of tube sinking process and its ability to predict wall thickness variation has been proven. Results of investigation gives an indication that the model can be used to simulate tube sinking process for wide range of drawing parameters.

K.Swamiphakdi, G.D.Lahoti et al. implemented a special purpose pre and post processing program to simulate tube drawing by using ABAQUS .Which is use for determination of drawn tube dimensions, mechanical properties and drawing forces

Stanislaw Urbanski and Marek Packo developed a matrix method simulation program considering the mandrel drawing of tubes which is validated with experiment.

Ramanan Kartik developed DRAW software on VAX/VMS operating system with recommendation of PC compatible version developed on windows environment which is readily available and more useful for the industry in designing of dies.

A.L.R. de Castro concludes that die semi-angle has more effect on mechanical properties in single pass drawing as compared to multipass drawing by experiment.

Bradley N.Maker and Xinhai Zhu introduces LS-DYNA for metal forming simulation as FEA tool showing its ability to simulate the process. Also their work presents a standard procedure for conducting metal forming simulation with LS-DYNA showing guidelines for future work.

The limitations of different approaches adopted for tube drawing procedure simulations by analytical, numerical and experimental models is discussed in above section. Generally the major contribution to the spring back is based on the length of the die and plug land (die geometry). The die and plug entry angles are made optimal based on maximum cross section reduction with minimum load. Papers studied shows that many investigators work on analytical, experimental and numerical methods cold drawing process analysis, but less work related to effect of variation of die land on elastic recovery problem in process is found. Thus spring back study by using finite element software's like ANSYS can be done which will be validated by experimental results.

4. OBSERVATION AND DISCUSSION

The cold drawing process is generally a precision pipe making procedure in which the accuracy of the product manufactured is maintained. The problems faced in the cold drawing process are discussed above. One of the major problems faced in cold drawing process is elastic recovery (spring back) in the drawn tubes. In this report the major emphasis is given on the spring back studies of circular pipes and dimensional stability.

A general study will be done on estimation of the spring back, causes of spring back and techniques to reduce it. A contact non-linear analysis in ANSYS will be done in order to simulate the cold drawing process in which the spring back and the dimensional study will be carried out. The simulated results will be compared with the practical results for verification.

5. REASERCH OBJECTIVE

- To measure Elastic recovery in various shaped Seamless pipe
- To study defects in hexagonal tubes of cold drawing process.
- Study of different designs for dies and plugs.
- Modeling of Dies & Plug for hexagonal shaped tubes using CAD software.
- To simulate the cold drawing process using ANSYS and analyze the results.
- Optimization of the tool profile (Dies and Plugs)
- Reduction of the cost of expensive trials required for new product or procedure development.

6. REASERCH METHODOLOGY

- Designing of Die and Plug for sectional Tubes (circular OD and hexagonal ID) Using CAD.
- Simulate the Process by Using ANSYS as finite element analysis Software.
- Dimensional Study for spring back.
- Validation with Experimental results

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