

A Review on Analysis and modification of Tailor Welded Blanks

**Dodiya Hussain¹, Farhan Meman², Tankawala Mohammed Nadeem³, Saiyad Riya⁴,
Mr. Parth Shah⁵**

¹⁻⁴B.E. Mechanical, Sigma Institute of engineering Vadodara, Gujarat-India.

⁵Assistant Professor, Mechanical Department, Sigma Institute of engineering Vadodara, Gujarat-India

ABSTRACT

The advanced development in manufacturing field and increasing living standards of people has led the manufacturers and engineers to put on some advance technique or technology in manufacturing field that satisfy customer needs as well as product design should be economical and proves to be beneficial for the industry as well as for the customer. Hence, an advance technique has been applied by many researchers that is Tailor welded Blank. It is a process where metals of two different thickness, size, properties and surface coatings are joined to form a single sheet blank prior to forming. Tailor Welded Blank plays a major role in Automobiles sectors. As the cars are been in use by majority of people, it demands the satisfactory product with less defects or limitations. With this review paper we highlight and focus some of literature related to Tailor Welded Blanks and any changes applied in TWB till now to make it a efficient welding technique

Keywords : Tailor Welded Blanks, Analysis of TWB, Welding Properties, Material Modification, Testing of Materials.

I. INTRODUCTION

Tailor Welded Blanks has wide range of applications in Automobiles as of now. Tailor Welded Blanks process involves less cost and time consumption is less. Hence, it proves to be economical to use Tailor Welded Blank in Automobiles. Tailor Welded Blanks reduces weight and cost of the car body and material to some extent due to usage of lightweight material in Tailor Welded process. They are joined together by using different welding processes such as, electron beam welding, laser welding, induction welding etc. there are many advantages of TWB, amongst which

one of the greater advantage is it eliminates the scrap of sheet metal after welding as it is used for new blanks in this TWB technology, while previously the scrap of sheet metal after welding goes to scrap before using of Tailor Weld method. The following description contains the review of some literature referred on Tailor Welded Blank and what efforts has been applied till by the researchers to improve the Tailor Weld Blank technique.

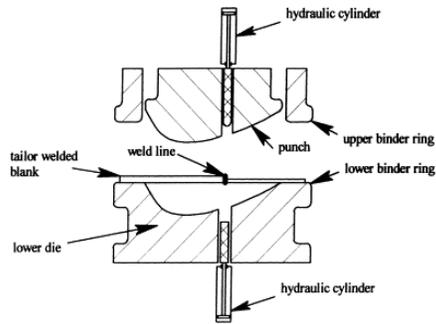


Figure 1- Tailor Welded Blank

II. LITERATURE REVIEW

Dr. R. Uday kumar, (2017). Reviews his research on forming characteristics of TWB's and some failure modes of Tailor Welded Blanks which states, the factors affecting the formability of TWB's are divided in three categories that is, Material, Process and Test equipment design, when the material is considered the factors like strain hardening coefficient, anisotropy, grain size, etc. affects the formability of TWB's, when process is considered the factors like mode of stretching, strain path, deformation speed etc. affects the formability and in case of testing equipment design factors such as draw bead, die corner radius, punch corner radius affects the formability of Tailor Welded Blanks. one of the failure in TWB takes place in the weld and gradually propagates to other sections, this failure takes place when straining is parallel to the weld line. The second failure is when the thinner weaker base metal fails this failure takes place when straining is perpendicular to weld line. While studying this forming characteristics of Tailor Welded Blanks, it represents the formability of Tailor Welded Blanks is mainly depends on orientation of major strains with respect to transition zone which includes both weld and heat affected zone.

A.A. Zadpoor, J. Sinke and R. Benedictus (2007). Has analysed the mechanical properties of TWB's, formability of TWB's and failure and fracture of TWB's, by experimenting tensile testing, analyzing tensile properties, formability of TWB's and failure analysis of failure modes in Tailor Welded Blanks. We have reviewed the mechanical behavior of TWB's in this paper also the formability of Tailor Welded Blanks. Formability of TWB's is dependent on the orientation of major strains with respect to transition zone. The size and properties of transition zone varies with welding method employed. By referring this paper two types of complexities we reviewed associated with formability analysis of Tailor Welded Blanks such as, spring back behavior of sheet metals changes and material flow phenomenon arise.

M. Uchihara, and K. Fukui, analyzed about how high strength steel sheets is useful in Automotive structures for weight reduction as well as for energy consumption for environmental concern, it states that the combination of high strength steel sheet and Tailored blanks provides the best solution for reducing body weight. The author provides the information of high strength steel useful for weight reduction by performing different tests, considering welding processes and its parameters and analyzing welding parameters for high strength steel. This literature helped us to review on that to reduce the automotive body weight without any declines in the body performance, high strength steel can be optimal material for designing automotive body structures.

K. Shibata, H. Benedictus, the Japanese researchers have implemented the efforts to use the Nd-YAG lasers for Aluminium Tailor Welded Blanks. The literature in this paper is on to apply Nd:YAG laser to welding of Aluminium alloyed Tailored Blanks to investigate the relationship between weld quality and strength and to clarify the differences between Aluminium tailored blanks and steel tailored blanks by stating that the Nd:YAG laser has a wavelength as short as 1/10 compared to CO₂ laser. Thus, by referring this paper it helped us as in which laser to be used in aluminium tailored blank and steel tailored blank to optimize strength of both materials as well as to be concerned with environmental effects.

Toshiyuki Takasago, Takao iwai, has studied some research work on Tailor Welded Blank as and when the Tailor Welded Blank started. This literature provides us history of Tailor Welded Blank that started in mid 1980's and is currently applied to automotive body in the world. The purpose is that integrating pressed parts and weight saving by optimum layout of panel thickness and material. Toyota started to use Tailored Blank in the 1980 and in 1989 the Tailored Blank has been used with different material and thickness for side panel of Lexus LS. We have reviewed this paper and it provides us useful information about the origin of TWB's that why and when it started.

Amir Abbas Zadpoor, Jos sinke and Rinze Benedictus, (2009). Has tested and analyzed the mechanical behavior for the products of adhesively bonded Tailor Welded Blank. This literature refers to that joining of two different materials and thickness joined in single sheet is

called Tailor Weld Blank is the promising technology for both Automobiles and Aircraft industry, although this technique is used only in automobile sectors and not in Aircraft industry because high strength aluminium alloys used in aircraft industry are sensitive to high welding temperatures. Thus, this literature reviews the study of mechanical behavior of adhesively bonded TWB's by experimental and numerical viewpoints and both the results are then compared. Therefore, this literature provides recommendation that forming process should be designed such that in plane plastic straining is minimized to use it for Aerospace sectors as well.

Yanli song, Lin Hua. (2014). Has analysed that Tailor Welded Blank is a method of joining two different materials of different thickness to form a single sheet blank. Where, a drawback is that a drop occurs in formability due to presence of welds in product. This paper concerns on how to overcome such drawback where, author researches on the influence factors of formability of Tailor Welded Blanks. Up to now everyone focus on the influence of stamping process parameters on the formability of Tailor Welded Blanks. As for the influence of thickness ratio of base sheets only few reports can be found. By Shakeri et al. (2002) point out that thickness ratio of base sheets is a significant factor affecting failure types of Tailor Welded Blanks. Hence, this literature provide us relevant to formability prediction of Tailor Welded Blanks made from dissimilar base sheets, by conducting series of stimulation and experiments of Erichsen cupping tests for Tailor Welded Blanks.

T. Kishore kumar and K. Jaysimha Reddy,(2015). Has analysed the welding properties of Tailor Welded Blanks of different materials and different material considered under the influence of appropriate weld processes. Specimens welded by Tungsten inert gas welding and Arc welding were analysed and tested the Tensile strength, shear strength and the impact strength of the material. Thus, while reviewing the paper we conclude that, impact strength of our considered specimen which is joined by using both TIG and ARC Welding's in parallel and perpendicular to the weld is more than the Mild Steel.

Gurel Cam and Guven Ipekoglu. Has performed a study on that Aluminium is the third most element in vast quantity in earths crust. Aluminium has unique properties such as appearance, light weight, fabricability, specific strength and corrosion resistance compare to other materials. Moreover, the density of Aluminium is also bit higher than that of magnesium, despite of this Aluminium has much wider use than Magnesium due to its unique and much higher formability property. Thus, this literature summarizes the development of joining Aluminium alloys in recent years and also about the different methods used for joining Aluminium alloys by fusion and resistance welding, soldering and brazing and mechanical methods such as riveting and bolting.

Yan Qi, Implements the new method or technology in the Automobile sectors with the help of Tailor Welded Blanks. This literature concerns on the development in Automotive industry with the help of Tailor Welded Blanks applying in the automobiles sectors which

portrays that TWB's can be applied on Automobiles doors, inner panel of doors and roof etc. The development in automobiles by implementing Tailor Welded Blanks was biggest change in Automotive industry. Hence, this literature concludes us that on applying TWB's in Automobiles greatly reduces its Weight and Cost. Therefore, light weight car body is provided using Tailor Welded Blanks.

III. CONCLUSION AND FUTURE SCOPE

This Review paper, describes some relevant facts for Tailor Welded Blanks and also focuses some important information regarding Tailor Welded Blanks. Whereas, Tailor Welded Blanks has been implemented in Automobile sectors and there's no development in applying TWB in Aircraft industry, as the high Aluminium alloys in Airplanes cannot withstand high welding temperatures. This literature review provides some basic information on Tailor Welded Blanks and also which material is been in use for Tailor Welded Blank, which is best suited material for Tailor Welded Blank and why the materials cannot be use in Tailor Welded Blanks. Thus, the following conclusions can be made from this literature review:

Tailor Welded Blanks is using Aluminium alloys for Automobiles therefore it cannot be applied on Aircraft industry due to high welding temperatures.

Tailor Welded Blanks in automobiles has proved to be a biggest change in automotive industry as it reduces the weight of the car body, forms customer satisfactory product and save fuel

consumption and manufacturing time to some extent.

Tailor Welded Blank reduces the scrap of welding sheet after welding that proves to be reduction material cost.

Further, it provides which laser to be used in Tailor Welded Blank like Nd-YAG lasers, for better joining and strength of the product. Failure, formability and fractures in Tailor Welded Blanks has also been concluded through this literature work.

Based on the conclusions obtained from the above literature some modification can be implemented in Tailor Welded Blanks in future:

Tailor Welded Blanks as of now uses Aluminium alloys for Automobiles. Hence, High strength steel or Mild Steel instead of aluminium can be applied as material in Tailor Welded Blanks.

Combination of high strength steel and M.S. forms a Tailor Welded Blank which can be formed and undergo some tests to prove its strength and durability then aluminium to implement the materials in Tailor Welded Blank. Based on the results one can decide to implement a new material in Tailor Welded Blank process.

Research on other materials can testing can also be performed in future for TWB's.

IV. REFERENCES

1. Dr.R.Uday Kumar¹ ¹Associate Professor, Dept.of Mechanical Engineering, Mahatma Gandhi Institute of Technology, Gandipet, Hyderabad.
2. TKishore Kumar¹, K.Jayasimha Reddy² ¹Assistant Professor, Department of Mechanical Engineering, Dr.K.V.S.R.I.T, A.P. India.
3. Vikram Viswanatham "Journal on Materials and Manufacturing , vol. 110, Section 5, pp673-679(2001) ", Northwestern University ,Evanston.
4. V.R.Radha Krishnan, "Welding Technology and Design"
5. P.C.Sharma,"A Text Book of Production Technology",Chand Publications.
6. M. Garware,ASM International Journal-2010.
7. Jian Cao, "Journal of Manufacturing Science and Engineering". Department of Mechanical Engineering, Northwest University,Evanaton.
8. Waddell,W., Weld. Met. Fabr., 3(1995),104-108.
9. Yan, Qi, China Welding, 2(2002), 143-147.
10. Yan, Qi, SPIE, 4915(2002), 117-123. YAN Qi Director Researcher, International Welding Engineer (IWE).
11. F.L. Saunders and R.H. Wagoner ~~Metallurgical~~Metallurgical and Materials transactions A, September 1996,volume 27, issue 9, pp 2605-2616.
12. J. Rojek, A. Bokota Institue of fundamental technological research polish academy of sciences 02-106 Poland. Volume 12, issue 2, june 2012 pages 156-162.