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Recent Publications

Accepted

1. A.B. Abdullah, M.S.M. Zain and Z. Samad, "*Delamination assessment of punched holes on laminated composite panels based on the profile measurement technique*", International Journal of Advanced Manufacturing Technology, In Press, 2017. (IF 2016 = 2.209 Q2). doi:10.1007/s00170-017-0545-1

Active Grants

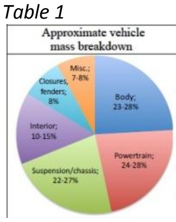
Title: Modeling of Twist Springback Pattern of Aluminum Alloy Strip with Non-Uniform Section.
FRGS (2014 – 2017)
Title: Precision Punching of Composite Panel
RUI (2015 – 2017)

Preface

Constant government regulation on fuel economy and shifts in customer demand are the two most important driving forces for the automakers to manufacture more economic and environment friendly vehicle. Over the period of 1987 to 2013, vehicle weight increased by 19.77%. Increased weight of vehicle is responsible for low fuel economy and higher CO_2 emission. For 10% weight reduction, fuel consumption is reduced by 6%-8% and every liter of gasoline burned releases about 2.4 kg of CO_2. There are three strategies for weight reduction from literatures, namely as (1) design optimization by numerical simulation, (2) using lightweight material and/or material alternative and (3) Use of advanced manufacturing technologies. Advance numerical simulation focus on design optimization includes multidisciplinary design optimization (MDO), Topology optimization and genetic algorithms. One of the important systems in automobile, body-in-white (BiW) as summarized in Table 1 represents tremendous opportunity of weight reduction. In addition, material substitution by advanced high strength steel (AHSS), aluminium and magnesium over steel provides scope for weight reduction tailor blanks offer advance manufacturing technology where formability of blanks offers weight reduction of components.

Table 1

Approximate vehicle mass breakdown



System	Major components in system
Body-in-white	Passenger compartment frame, cross and side beams, roof structure, front-end structure, underbody floor structure, panels
Powertrain	Engine, transmission, exhaust system, fuel tank
Chassis	Chassis, suspension, tires, wheels, steering, brakes
Interior	Seats, instrument panel, insulation, trim, airbags
Closures	Front and rear doors, hood, lift gate
Miscellaneous	Electrical, lighting, thermal, windows, glazing

(Credit to Md. Tasbirul Islam, former PhD student who initially prepare this writing)

Revisit Norstar Technology at Perda

On 6th of June 2017, the Metal Forming Lab team has visited Norstar Technology Sdn Bhd. Norstar Technology is a SME company that focus on producing metal forming parts. The company major customers are Nansin, Honda and many more. Previously the company produce oil filter as their own product. During the visit, Mr. Wan Ishak, the owner of the company gives advice to us in doing research. The discussion also involves opportunity of potential projects and available grants for SME's such as E-Dana and PPRN. The visit ends at approximately 3.30 pm.

Research Summary 1

Name: Mohd Fadzil Jamaluddin (PhD)
Title: Formability analysis of laser welded dissimilar aluminium tailor welded blanks (TWB)

Dissimilar sheet metal components are potentially useful in lightweight and multifunctional applications. These components are produced from welded dissimilar metal blanks, also known as tailor welded blanks (TWB). Their dissimilarity is in term of sheet thickness or different alloys. Such technology is important in the automotive industry, as metal formed components account more than 85% (by weight). The adoption of light metals, such as aluminium, is a near-term solution for light-weighting, and the use of aluminium welded TWB provide further potential for weight reduction. However, the capacity to rapidly join dissimilar aluminium sheet of different thickness and alloys, and characterization of post-weld formability has yet to be fully explored. Potential applications of aluminium TWB are primarily used in the automotive industry to produce parts such as side frames, doors, pillars and rails. Other potential applications are in the alternative energy, appliance, trucking, rail car, shipbuilding, construction, trailer, elevator/escalator, and furniture. The objective of this research is to determine the formability of TWB made from combinations of different thickness and grades of aluminium alloys. The joining and formability of dissimilar alloy combinations remains a significant challenge, due to the differences in material properties inherited from the parent materials. It is hypothesized that the selection of material combinations, sheet thickness and the joining parameter used, and the presence of welding resultant effects (such as heat affected zones, and intermetallic compounds) would influence the FLD of the welded blanks.

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COMMON DEFECTS IN DEEP DRAWING PROCESS

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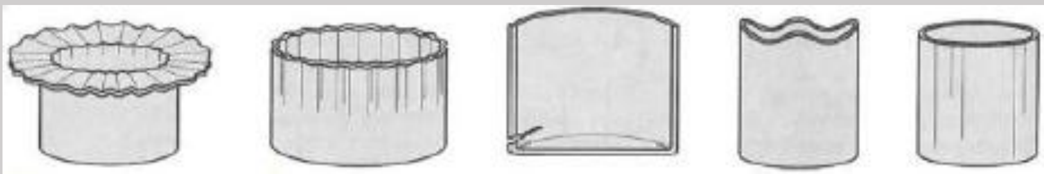
Abstract

Investigation of defect on a deep drawing process (DDP) is compulsory for producing high quality part. Wrinkling, thinning and earing among common defects that usually found in the DDP due to improper parameters setup. Significance parameters such as punch and die radius, blank holder force, punch speed and force, alignment between punch and die, lubrication and blank shape are important that should be considered while dealing with the DDP. Optimum value of those parameters required to produce defect-free parts. Neglecting of those defects will contribute to major effect such continues of part reject in production line. Thus, eliminating causes of those part defects will assure a high quality part is produced.

Introduction

Metal forming process is an important production method in current automotive industry. Frame, main chassis and doors are examples of car components that produced by using specific metal forming works. High production volumes with a minimum cost become an essential factor for any player of automotive field in selecting suitable production method for their product. Sheet metal forming is an efficient and economic production process [1]. Optimum parameters selections on DDP are required in order produce high quality parts without any defect. A properly designed drawing process is essential to producing a defect-free part [2]. In deep drawing a blank is drawn over a die by a punch. The blank is drawn radially inwards the flange undergoes radial tension and circumferential compression. A blank-holder applies sufficient pressure on the blank to prevent wrinkling on the flange [3]. Basically, there are four common defects that usually occur on DDP process namely thinning, earing and wrinkling and surface scratch as shown in Figure 1.



(a) (b) (c) (d) (e)

Figure 1. Defects in deep-drawn cylindrical cups [4], (a) Flange wrinkling, (b) Wall wrinkling, (c) Tearing, (d) Earing and (e) Surface scratches

Defect of DDP

Thinning is often considered as failure criterion in the metal forming industry. In high-strained parts even cracks may develop if nothing is undertaken to stop material thinning [1]. It occurs near the base of the drawn cup and results from high stresses in the vertical wall that cause thinning and failure of the metal at that location [4].Thinning occur due to smaller radius at punch or die because higher punch load required and produce higher stress on blank resulting in thinner wall thickness. Thinning on DDP also occur when there are misalignment between punch and die itself. Severe thinning condition will cause part tearing. Optimum punch and die radius and accurate alignment between punch and die are required to avoid thinning condition. Secondly, wrinkling is also a defect that usually occurs on DDP. Wrinkling may be defined as the formation of waves on the surface to minimize the compression stresses [5]. There two condition of wrinkling, namely wrinkling on the flange and wrinkling on wall of product. Wrinkling on flange occur when ridge form radially on flange due to compression force while drawn took place. Wall wrinkling occur when ridge of flange are drawn in vertical wall of cup [4]. Too large die radius will introduce to this type of defect. Thus, proper blank holder force and optimum die radius will minimize and eliminate wrinkling on flange and wrinkling on wall of product. Earing is also one of defect on DDP. Earing is an effect of material characteristic; anisotropic material. This material is stronger in one direction compare to other direction. Figure 2 illustrate various defect in square deep drawing of AA1100. Extra material is drawn and trimmed is the practical solution to eliminate defect of earing on DDP. Lastly, common defect on DDP is surface scratches on part of DDP due to surface punch or die not smooth and clearance between punch and die too narrow. Thus, suitable lubricant and proper clearance between punch and die should be applied during drawn process. Lubrication oil is usually applied on blank surface before performing drawn process.

Figure 2. Square deep drawn part with various defect can be observed.

Conclusions

Common defect on DDP such as wrinkling, thinning, wall scratching and tearing able to be minimized if causes of those defect were eliminated during designing stage and production stage. Optimum punch and die radius, blank holder force and suitable lubricant applied among remedies that able to be considered for producing defect-free part. Recently, Finite Element Analysis (FEA) software is used to obtain significance parameters and recommended values for fabrication defect-free die set of DDP.

References

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