LITERATURE REVIEW ON REDUCING WASTE AND DISCARD IN DIRECT EXTRUSION PROCESS

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ABSTRACT:
Commercial forward extrusion of aluminum involves different operations, such as billet preheating, and shearing loading and deformation, stretching and roll correction, age hardening because of high tool and equipment involved it is vital to understand the relation between the condition of the extrusion press and ancillary equipment and their performance measured in term of productivity and recovery. This is turn necessitates an understanding of the contributing and controlling factor related to product defect in extrusion. The quality of extruded product is a function of various factors, such as chemical composition, geometric dimensions, appearance, variation of mechanical properties over the extruded length and cross section, and surface finish. Extrusion defects may arise in extruded product from the starting material or billet size. In the first part of article to describe the various types of product defects in commercial aluminum extrusion. In second part of the article proposes a generalized calculation model for reduce the amount of waste at processing or post-processing stage. Real world data from local industry is used for cost analysis.
KEYWORDS:
Aluminum extrusion, product defects, origin of defects, defect classification, operational cost, cost model, cost analysis

INTRODUCTION:

Aluminum extrusion is mostly a hot metal-forming operation. The extrusion procedure Starts With forcing a preheated billet after that billet placed in a heated chamber, through a die Which is operated with ram. This Procedure is General but it will change with arrangement and requirement of product. The forward extrusion process is a very complex one with many variables who affect the products, in which some can be controlled like temperature, extrusion speed, lubrication, while others cannot be controlled. The final product is affected by these variables, resulting in different characteristics. Some of those characteristics appear on the aluminum profile surface in forms of defects (undesired results). The surface defects that generally found in the product are blisters, die-lines, pick-up, tearing, color streaks, weld lines, black lines and scratches. [16]

LITERATURE REVIEW:

1.A.F. ferras(2019) find variables concerning with extrusion temperature, time, ram speed, pressure and die geometry are crucial to improve and control the scrap production. Attempt to study on this to finding the parameters who affected extrusion profile.
2.Sukunthakan ngernbamrung(2019) Finds During the hot extrusion localization of heating by friction at the interface between billets and tool leading to a temperature increase close to melting point with the higher tension stress at the edge of die region.
3.Florian Eger (2017) Finds To obtain the highest quality throughout the production process avoiding failures Minimize waste. wastage could be both waste material and wasted time due to unnecessary rework.
4.Abdullah Wagiman(2019) finds the technique for reuse the aluminum chips. Without melting and casting, the technique offers less energy consumption and time, fewer aluminum losses and short time cycle which benefit the environment and cost. The technique can be used to produce semi-finished or finished extrudates profiles either as standard aluminum alloy or aluminum composite. It was found that the properties of the extrude profiles are governed by chip consolidation and grain size. Several major factors are identified including the chip size and lines, treatment, compacted billet, die design, extrusion parameter and post-heat treatment.
5.Sang-hoon Kim (2016) find the reduction in billet size results in an increase in the strain rate used during hot extrusion The size of coarse grain decrease and the quality of area of fraction of the fine grain increase with decreasing billet size.
6. S.N. Ab Rahim (2015) For Aluminum Alloy, higher ram speed or extrusion ratio for the ECAP die led to a slight decrease of strength and ductility for the extrusion due to higher deformation temperature. In the recycle of aluminum there are unwanted billets and some defected pieces also added but at the end there are 75% of aluminum are be recycled and 25% are dross and ass.
7. S.S.Gadekar(2014) The quality Problems(cause) are Become inappropriate setting of operational as per observation To identify the impact on Product quality. Some of the important parameters are condition of equipment's, operating conditions, temperatures, pressures, quality of dies, materials. Instead of the profound efforts from the manufacturers, still there are number of difficulties in the process which lead to defects in the product.
8. Mohamed Ibrahim Abd El Aal (2014) find the tensile strength result were successfully predicted through strengthening model and fit the experimental results well. Ductile tensile fracture surface mode and morphology were observed in Al-1080before and after deformation by the different deformation processes.

9. Yahya Mahmoodkhani(2013) find The Effect of feeder geometry had large impact on the size of dead metal zone and length and thickness of transverse weld in extrude The extrusion ratio also significantly impacted the transverse weld length. strain rate and strain distribution in the heated billet/extrudate at any position in the extrusion container and die.
10. V. Güley(2013) find The positive effect of the use of the extrusion porthole die can be observed in the increased ductility of the aluminum profiles manufactured from machining chips. A fracture strain of 26% corresponds to more than 80% higher ductility while compared to the aluminum profiles extruded through the flat-face die.
11. A. F.M. Arif(2011) find This conducted to record pressure variation against the ram advance for solid , hollow , and semi hollow dies of varying complexity and different ram speed. Die complexity, usually defined by "shape factor" (the ratio of the parameter to the cross-sectional area of the profile), critically affects the flow of billet and the pressure required to extrude a given aluminum product.
12. N.Solomon(2010) find the Careful design of the extrusion die profile can therefore control the product structure Mechanical properties in cross-section of the extruded product can be controlled when a die with a fillet radius in bearing surface is used.
13. T. Sheppard (2010) find the softening mechanisms operative during extrusion are dynamic recovery, and dynamic recovery followed by dynamic recrystallization for high and low stacking-fault energy materials, respectively.
14. Ramona holker(2013) find to prevent overheating of workpiece material and extrusion die with local cooling was manufactured by selective leaser melting as an advance manufacturing.
The advantage of SLM is geometric freedom which is used to produce multidirectional channel for cooling medium and thermocouple for temperature measurement. SLM increase production speed and billet preheating temperature.
15. L Donati , L Tomesani(2005) find The use of different types of feeder or welding chambers determine the same product strength But a significant improvement in product deformability can be obtain with larger welding chambers A profile with a central transverse weld line suitable for mechanical testing is extruded under different processing conditions, by different dimensions of the die feeder, the length of the welding chamber, the billet preheating temperature, pressure and the process speed. For each condition the efficiency area was defined by defining tearing defects in the production stage.
16. A.F.M. Arif(2002) find the most of the defects and waste are produce with the size of billet choosing for extrusion and it relates surface, temperature, speed, die geometry, weld joint and etc. to reduce this thing make sure all parameters are in control like extrusion billet size, cutter position, puller speed, die entry angle, conveyor rollers surface, temperature, speed.

Body:

The extrusion ratio also significantly impacted the transverse weld length. strain rate and strain distribution in the heated billet/extrudate at any position in the extrusion container and die.
Defects in extrusion. An extrude profile may be deemed to be reject (unacceptable product that does not fulfill standard or customer specification), owing to any of the following reasons:
(i) Faulty billets (slag/impurity inclusion, scales/flakes, internal cracks, undissolved oxides, etc.)
(ii) Weld defects
(iii) Surface defects
(iv) Shoddy or unsuitable tooling

1.1Defected billet:

Parameter affecting the billet performance, extrusion speed, die geometry, shape, size of billet, Billet quality directly depend on mechanical properties of billet and die
higher preheating temperature in log machine and longer heating time of billet could improve the workability of the billet. The softer billet could permit high shear strain to enable severe plastic deformation
If the speed and temperature of the ram increases, then the billet cannot withstand it, so the billet will burst and the die will open.
If the size of the billet is chosen in a certain proportion, the amount of overproduction can be reduced [9]

1.2 Weld defects:

Fig 1weld defects

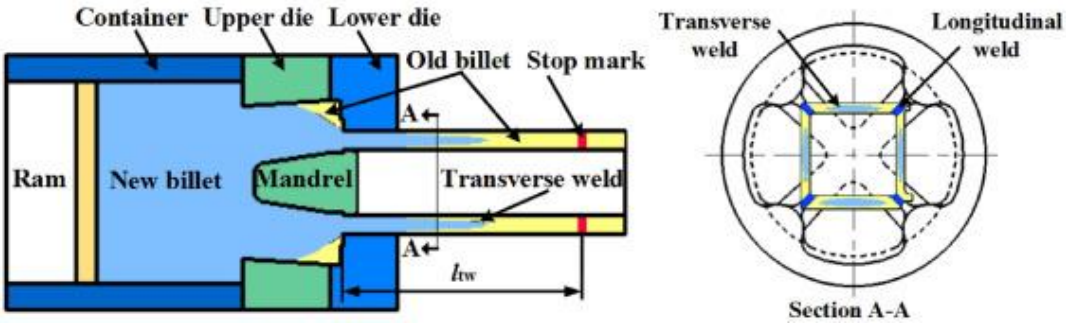


Fig 2 Transvers weld, Longitudinal weld

Different lengths of product welding chamber mainly affect the welding path length and the maximum pressure in the product welding chamber. Simulation was conducted under three different welding chamber heights of 4mm, 7mm and 10 mm, initial billet temperature of 450 ℃, extrusion velocity chose 10 mm/s and the back dimension of die leg D= 1.2 mm. During the extrusion processing, the welding pressure in the chamber is proximately equal to means stress. If the area or surface of the billets were perfectly clean, or lubricated there would be no weld problem

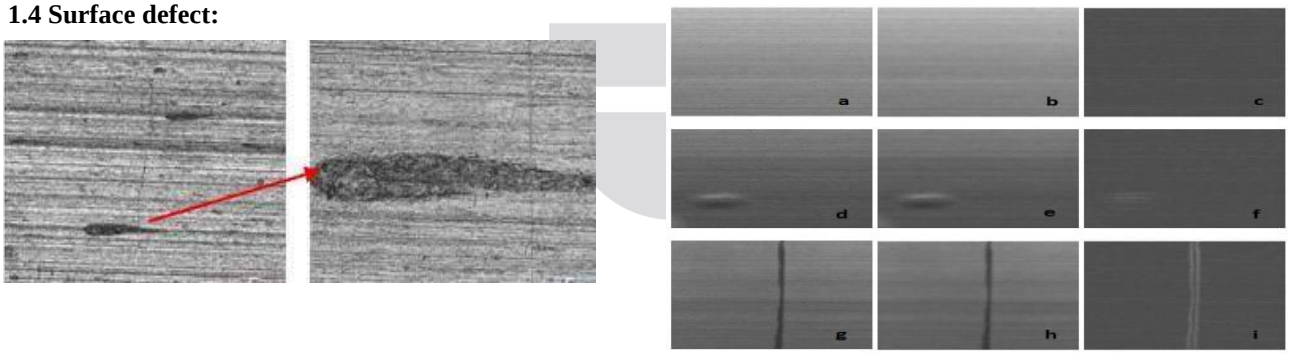
in the experiment the billets ends are always oxidized, and the sheared face is often contaminated by stray lubricant and oxidized metal from shear blade. The presence of transverse weld and its associated contamination is close proximity to the seam weld continuous the lines of weakness in product thus longitudinal weld defects takes the form of either low weld toughness or streaking on anodizing

1.3 Shoddy or unsuitable tooling:

Fig.3 unwanted piece by cutter and bending

In Pre extrusion tooling include Hot log machine, billet cutting and transfer to press, die preheated ovens, extrusion press, die with dummy block, In Post extrusion tooling include Extrude conveyors rolls, puller machine, correction table, any of this can generate defects like die Spot, Black lines, white lines, Oil patches, scratching, swelling Etc. [15]

1.4 Surface defect:



Surface defects Are normally generated after extrusion is completed, it is caused by conveyor roller**,** puller, saw cutter and stretching machine, conveyor roller produce defect as shown in fig 6 can clearly see marks on extrusion surface, fig 7 a shows the required surface finish and other are defects like b is blister defects, (c,f,I) are Sobel edge magnitude ,d is fig of Scratch Defects And (b,e,h) indicates transformation after noise removal.[10]

DISCUSSION:

The article is divided into two parts

1. Reduce waste of extrude aluminum profile by defects
2. Reduce the discard from billet in extrusion process

After the performing research on forward aluminum extrusion process to reduce extrusion waste, observed that billet size is most important factor which affect the production rate, if the company want to produce product of size "x"

It should take raw material enough to "x" not more than "x". when "x" raw material is more there is chance of damaging billet and die and it also need to remove material from extruded product. when extrusion is completed out of 100% only 80% are used to produce extrusion product, 20% are dross and ash. Dross is material which is stuck at furnace bottom which also need to remove after furnace cool down. So, company gets 20% loss on the production which is also high enough to get attention for research of alternative to reduce dross and ash. In current situation customer only want to pay for value added activity, customer is not going to pay for waste which ultimately pay by the producer. So, there is a need to reduce dross and ash and other rework like scratches, black lines, white lines, oil patches, die spot, bend, and other defect. That can be reduce by controlling the puller speed, conveyor speed, temperature of die cooling rate & to reduce chance of bending profiles using supportive roller which can reduce the chance of bend up to 90% preventing maintained the dies, roller and puller reduce chance of error and downtime which simultaneously going to increase productivity

Conclusion:

After briefly describing the parameters that affected productivity in this article, with the help of visual illustration the defects are defined and explain in the industry. The most of the defects and waste are produce with the size of billet choosing for extrusion and it relates surface, temperature, speed, die geometry, weld joint and etc. to reduce this thing make sure all parameters are in control like extrusion billet size, cutter position, puller speed, die entry angle, conveyor rollers surface, temperature, speed, and die cooling rate. if these parameters are in control the company can improve the production rate with less time period and with high productivity.

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