A REVIEW ON PARAMETERS OF BALL BURNISHING PROCESS FOR SURFACE ROUGHNESS

Ashvin Jakhaniya G. [1]

[1] *Assistant Professor, Mechanical Department, Swarrnim Institute of Technology, Gujarat, India*

ABSTRACT

Burnishing is the plastic deformation method; it's become additional common as finishing process. Thus, it's particularly crucial to pick the burnishing parameters scale back surface roughness. Within the study, the investigation of surface roughness on ball burnishing parameters are administered on atomic number 13 alloy. The Taguchi technique of surface roughness parameters (R_a) is developed considering the conditions as burnishing force (5,15,25 kgf), variety of tool passes (1,3,5), feed rate (0.068,0.1,0.205 mm/rev.) and burnishing speed (45,120,300 rpm).Optimal ball burnishing parameters were determined once the experiments of the Taguchi orthogonal array. This model has higher surface roughness prediction capability and pertinence to effective choice of burnishing parameters for higher quality merchandise.

Keyword: - *Ball burnishing, Taguchi Method, Surface Roughness, Burnishing Force, Feed Rate, Burnishing Speed*

1. INTRODUCTION

Burnishing is a surface modification method that produces a really swish surface end by the planetary rotation of a tool over a bored or turned surface. The tool could accommodates one or additional ball or roller. This method doesn't involve the removal of fabric from the work items. All machined or alternative processed metal surfaces accommodates a series of peaks and valleys that represent the surface irregularities. The force applied by the burnishing tool forces the fabric from the peaks to flow into the valleys. This reduces the peak of the peaks and depth of the valleys, thereby reducing the surface roughness. Burnishing method may be loosely classified into 2 sorts supported the pure mathematics of the tool. They are

- Ball burnishing
- Roller burnishing

The piece of work could also be at close temperature, or heated to cut back the forces and decline the tool. The tool is typically hardened and coated with special materials to extend its life. Ball burnishing, or ballizing, may be a replacement for alternative bore finishing operations like grinding, honing, or sharpening. A ballizing tool consists of 1 or additional over-sized balls that area unit pushed through a hole. The tool is comparable to a broach, however rather than cutting away material, it plows it out of the means. Ball burnishing is additionally used as a debarring operation. it's particularly helpful for removing the burr within the middle of a through hole that was trained from either side. Ball burnishing tools of another kind area unit generally employed in CNC edge centres to follow a ball-nosed edge operation: the hardened ball is applied on a zig-zag tool path in an exceedingly holder kind of like a ball-point pen, except that the 'ink' is controlled, recycled lubricating substance. This combines the productivity of a machined end that is achieved by a 'semi-finishing' cut, with a higher end than procurable with slow and long end cuts. The feed rate for burnishing is that related to 'rapid traverse' instead of end machining. Roller burnishing, or surface rolling, is employed on cylindrical, conical, or disk formed work pieces. The tool resembles a ball bearing; however the rollers area unit usually terribly slightly tapered so their envelope diameter may be accurately adjusted. The rollers generally rotate among a cage, as in an exceedingly ball bearing. Typical applications for roller burnishing embrace mechanism elements, shaft fillets, and waterproofing surfaces.

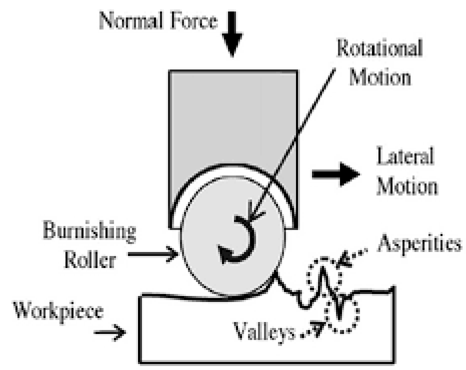

Fig -1:
Basic operation of burnishing

2. LITERATURE REVIEW

M Babic, V Kocovic, D Vukelic, G Mihajlovic, M Eric and B Tadic [1] reveals that Numerous research results indicate that the finishing processing of metal materials using ball burnishing has positive effects from the aspect of surface roughness decrease to the hardness increase in the surface layers of the processed materials. Little research has been devoted to this type of processing for non-metal materials. This paper presents research results related to the influence of ball burnishing processing on the hardness increase of a wooden element. It was determined that the hardness can be increased up to three times for processing of wood using this technology.

Harshal Patel and Ketan Sathavara [2] reveals that flame sprayed thermal coating is approach to improve wear as well as overall life of workpiece. but this type of coating have inherent irregularities and defects like micro cracks that cause energy dissipation and surface damage. To Overcome These Complications, Conventional Finishing Processed Such As Grinding have been traditionally employed. However, since this methods essentially depend on chip removal to attain the desired surface finish, these machining chips may cause further surface abrasion and geometric tolerance problem especially if conducted by unskilled operators. Burnishing is a cold forming process in which initial asperities are compressed beyond yield strength against load. The surface of the material is progressively compressed, then plasticized as resultant stresses reach a steady maximum value and finally wiped a superfine finish. This paper is deals with the thermal spray flame coating is used to increase wear as well as overall life of component and post machined by ball burnishing to achieve smaller surface roughness value and improving surface hardness.

P. N. Patel, N.B. Patel and T. M. Patel [3] reveals that optimization of newly design ball burnishing tool is used carried out experiment on conventional lathe machine with burnishing process parameters using taguchi analysis method. The work piece and ball materials used is Aluminium Alloy 6061 and high chromium high carbon with 8mm diameter. The levels of input process parameters are selected on basis of one factor at a time experiment are burnishing force, burnishing feed, burnishing speed and number of passes.

J. A. Travieso-Rodríguez, G. Dessein, and H. A. González-Rojas [4] reveal that the ball burnishing process is done to improve the surface finish of workpieces that have been previously machined. In this article we present the results of tests performed with this process that was applied to workpieces with a convex or concave surface of two different materials: Aluminium A92017 and steel G10380. An experiment to do the tests was designed. The results of measurements of surface roughness are presented in this paper as well. These results are compared to those measured in the workpieces before being burnished. After that conclusions are drawn about the improvement of surface roughness applied to the workpieces through the ball burnishing process.

3. PROCESS PARAMETERS

There are many process parameters that control the operation and outcome of burnishing process. Each of these parameters has to be optimized and controlled to get the best possible results. The most important parameters are:

- Burnishing force
- Speed
- Feed
- Number of tool passes
- Tool diameter and material
- Lubricant

The details of these parameters and their effect on burnishing process are discussed below.

Burnishing force: The force with that the tool is ironed against the work items is termed as burnishing force. This force acts commonly on the work piece surface. the quantity of force is controlled by the depth of penetration of the tool. Burnishing force is that the most vital and important parameter of the burnishing method, as a result of the surface roughness obtained depends on the force with that the tool is ironed against the work piece. The applied force ought to be high enough to deform or yield the surface asperities and create the fabric result the peaks into the valleys of the surface irregularities. the quantity of force needed to burnish a fabric mostly depends on its yield strength.

Speed: The speed with that the work piece is turned throughout burnishing is termed speed. In flat surface burnishing, wherever the work piece is static and also the tool is turned, the speed is mentioned the movement speed of the tool. Speed is usually measured in revolutions per minute (rpm) or meters per minute (m/min). Speed of rotation ought to be chosen supported the strength and dimensions of the work piece.

Feed: It is the speed at that the tool is fed or advanced on the work piece. it's expressed within the units of distance per one revolution of the work piece. Feed rate depends on the surface end needed. Lesser the feed rate additional are going to be the surface end, up to bound limit. therefore the feed rate ought to be optimized to get higher surface end.

Number of tool passes: It is the quantity of times burnishing method is continual on an equivalent work piece, at an equivalent set of parameters. In several cases continual burnishing is also required to boost the surface end. In some cases, the quantity of tool passes might go up to five, reckoning on the strength of the work piece material.

Tool diameter and material: The size and material of the tool (roller or ball) conjointly has impact on the surface end of the shining work piece. The fabric of the tool ought to be chosen specified it's higher hardness and toughness than the piece of work material.

Lubricant: As burnishing is a chip-less operation and also the quantity of warmth generated is additionally less, the influence of lubricator on the method outcome is additionally terribly less. In some cases burnishing is done even within the absence of lubricator. However it's suggested to use any less viscous lubricator, for simple movement of the bearings and rollers.

The selected input and output parameters and factors with level values after research and analysing the facts comes from the literatures and the books.

Table 1: Process Parameters

Input Parameters	**Output Parameters**
Burnishing Force (kgf)	Roughness (micro meter)
No. of Tool Passes	
Feed Rate (mm/rev.)	
Burnishing Speed (rpm)	

Table 2: Factors with levels value

Factor	Level 1	Level 2	Level 3
Burnishing Force (kgf)	5	15	25
No. of Tool Passes	1	3	5
Feed Rate (mm/rev.)	0.068	0.1	0.205
Burnishing Speed (rpm)	45	120	300

Input parameters and their levels:
Selected input Parameters

Table 1: Process Parameters

Process Parameter	Level 1	Level 2	Level 3
Cutting Speed (rpm)	800	1000	1200
Feed Rate (mm/ rev.)	150	200	250
Depth of Cut (mm)	0.5	1.0	1.5

CUTTING TOOL MATERIAL – Carbide Insert Cutter Tool

WORK PIECE MATERIAL – Aluminium 6061

4. REFERENCES

[1]. M Babic, V Kocovic, D Vukelic, G Mihajlovic, M Eric and B Tadic, "Investigation of ball burnishing processing on mechanical characteristics of wooden elements", J Mechanical Engineering Science 2017, Vol. 231(1) 120–127 in 2016.

[2]. Harshal Patel and Ketan Sathavara, "Experimental Investigation on ball burnishing process of surfaces produced by thermal spray", IJARIIE-ISSN(O)-2395-4396 in 2016.

[3]. P. N. Patel, N.B. Patel and T. M. Patel, "Parametric Optimization of Ball Burnishing Process Parameter for Hardness of Aluminum Alloy 6061 IOSR Journal of Engineering (IOSRJEN) in 2014.

[4]. J. A. Travieso-Rodríguez, G. Dessein, and H. A. González-Rojas, "Improving the Surface Finish of Concave and Convex Surfaces Using a Ball Burnishing Process", HAL in 2013.