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PARAMETRIC ANALYSIS OF SURFACE FINISH IN BURNISHING AND SHOT PEENING PROCESS

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ABSTRACT
Analyse the impact of roller burnishing and shot peening operations on the cylindrical work material, to achieving smaller roughness and better hardness of test specimens. The process parameters considered for roller burnishing process are tool material, force applied and the number of passes and for shot peening the process parameters are peening intensity, type of shot size and its material. The test specimens are aluminium and mild steel. Maximum burnishing force increases rate of surface hardness which tends to mitigate depends on decreased generating rate of new dislocations at high level.

KEYWORDS: Roller Burnishing, Shot peening, Surface finish.

I. INTRODUCTION
Burnishing is also called as chip less finishing process. It cold works the metal surfaces by applying the forces that exceed the yield strength of the material through hardened roller or ball.

Shotpeening the technique consists of propelling at high speed small beads of steel, cast iron, glass or cut wire against the part to be treated. The size of the beads can vary from 0.1 to 1.3 or even 2mm. The shot is blasted under conditions which must be totally controlled.

Surface Roughness

The surfaces of engineering components will provide link between manufacturing and their function in use. Provision and long term keeping of specified characteristics of machine parts greatly depends on their surface quality. The main cause of machine failures (80%) are wear of contact surfaces in mating parts. Wear resistance of rubbing parts can be improved by reducing the initial wear of components. In this line, it is better practice to make the sliding Surfaces with a roughness equal to that of worn-in parts.

Experimental procedure

Burnishing: The experiments were conducted on center lathe machine. Burnishing processes are conducted on this center lathe. In the present experiment tool post is replaced with a lathe tool dynamometer to hold the burnishing tool.

Shotpeening: The specimens were SP-treated from all sides using an air-blast machine. Cast steel shot MI-170H with a hardness of 55 HRC and a nominal diameter of 0.40 mm was chosen.

Test Specimens

In this experiment 6 sets of test specimens were considered which consisted of four materials Aluminum, Copper, Brass and Mild steel. Each specimen has 25 mm diameter and 100 mm length.

Table 1: The properties of the materials.

Material	Young's modules (MPa)	Poison's ratio	Density (kg/m3)
Aluminum	70	0.33	2700
Mild steel	210	0.30	7860

Surface roughness test before Burnishing and Shotpeening

After the turning operations the surface roughness of the samples has been measured using the surface roughness measuring instrument. The surface roughness values have been tabulated for each material.

Table 2: Surface roughness values of specimens considered.

Sl. No	R_a(µm)	R_q(µm)	R_z(µm)
Aluminum	1.714	2.113	10.813
Mild Steel	2.874	3.249	15.5

Where R_a is the average roughness of a surface, R_z is the difference between the tallest peak and the deepest valley in the surface and R_q root mean square roughness.

Surface roughness test after Burnishing and Shotpeening

Table 3: Surface roughness values of aluminium specimens measured after burnishing at different burnishing forces. change in surface finish.

No of Tool Passes	Surface Roughness, Ra(µm) At Burnishing force=34.4N	At Burnishing force=40.9N	At Burnishing force=47.3N	At Burnishing force=56.9N
1	0.741	0.657	0.568	0.547
2	0.63	0.547	0.455	0.419
3	0.221	0.197	0.154	0.132
4	0.326	0.275	0.201	0.187
5	0.397	0.364	0.319	0.278
6	0.409	0.396	0.387	0.318

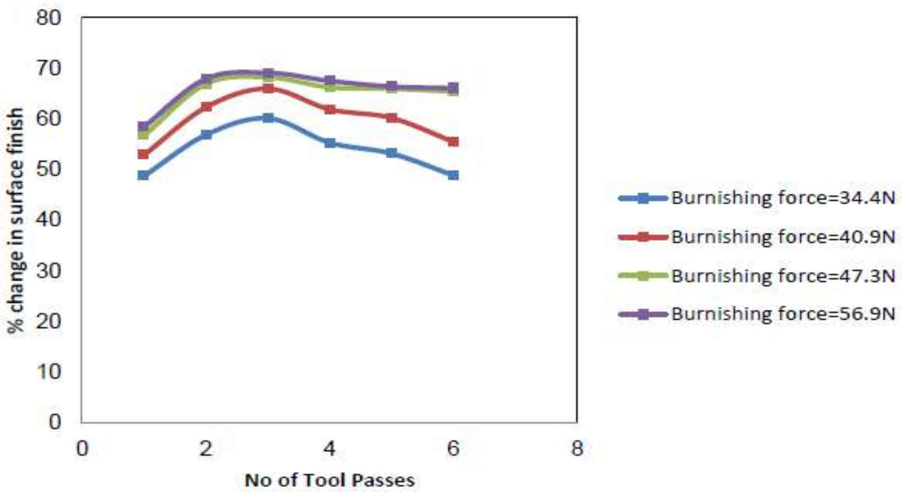

Fig. 2: Variation of surface roughness after burnishing for different number of passes.

It has been observed from fig 2 that the surface roughness (Ra) value decreased more for aluminum specimen from 1.714 to 0.132µm for number of passes equal to three

Table 4: Surface roughness values of mild steel specimens measured after burnishing at different burnishing forces.

No of Tool Passes	Surface Roughness, Ra (µm)			
	At Burnishing force=34.4N	At Burnishing force=40.9N	At Burnishing force=47.3N	At Burnishing force=56.9N
1	1.476	1.357	1.246	1.197
2	1.243	1.087	0.954	0.925
3	1.149	0.981	0.916	0.891
4	1.287	1.098	0.973	0.937
5	1.349	1.147	0.981	0.969
6	1.472	1.282	0.997	0.978

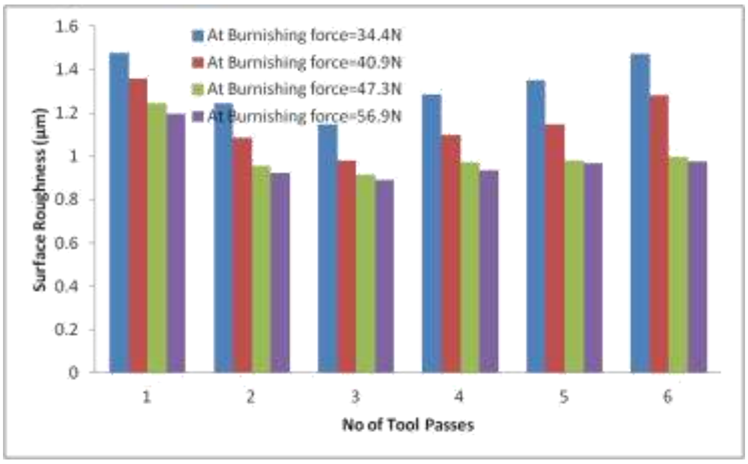

Fig. 3: Variation of surface roughness after burnishing for different number of passes.

Table 5: Comparison of surface roughness of aluminum specimens before and after shot peening.

Peening pressure (MPa)	Surface Roughness Ra (µm)	
	Before Shot peening	After shot peening
0.138	1.714	0.73
0.207	1.714	0.334
0.276	1.714	0.529

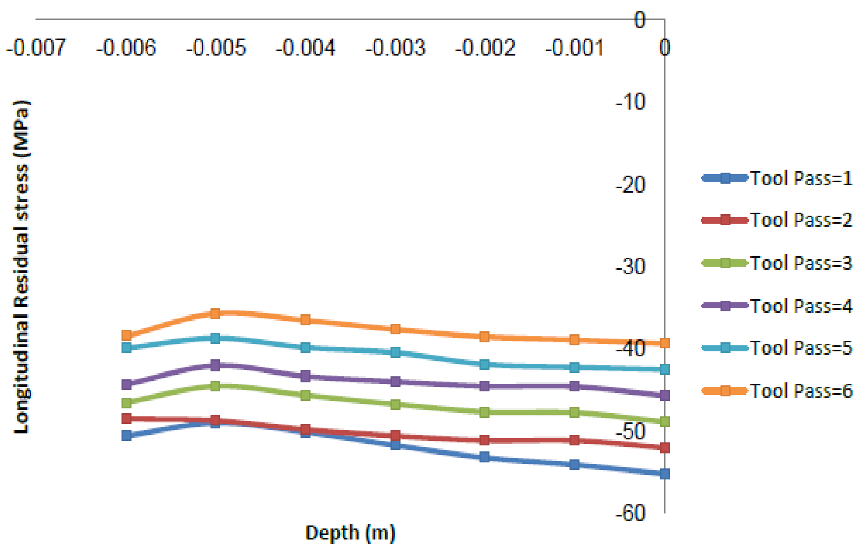

Fig. 4: Comparison of variation of surface roughness for aluminum specimens before and after shot peening.

Table 6: Comparison of surface roughness of mild steel specimens before and after shot peening.

	Surface Roughness Ra (µm)	
Peening pressure (MPa)	**Before Shot peening**	**After shot peening**
0.138	2.956	0.856
0.207	2.954	0.986
0.276	2.958	1.274

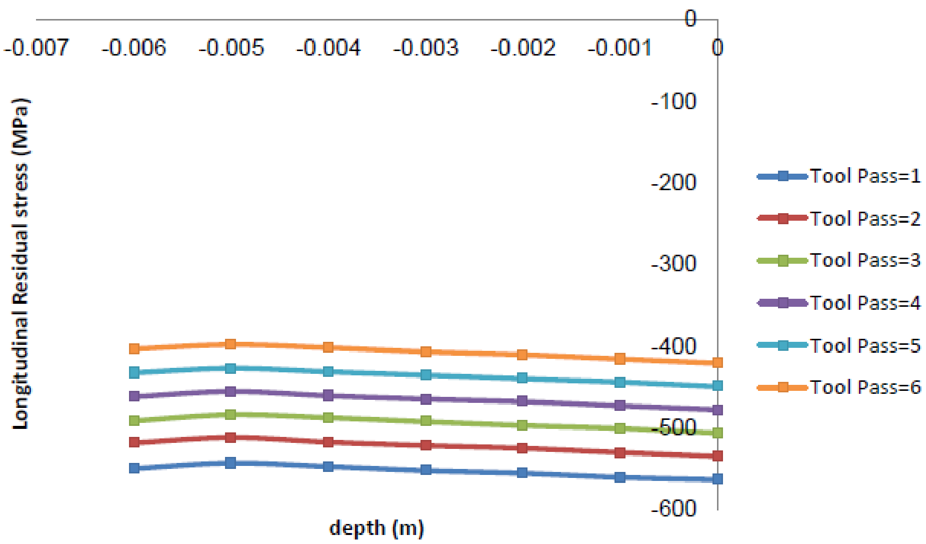

Fig. 5: Comparison of variation of surface roughness for mild steel specimens before and after shot peening.

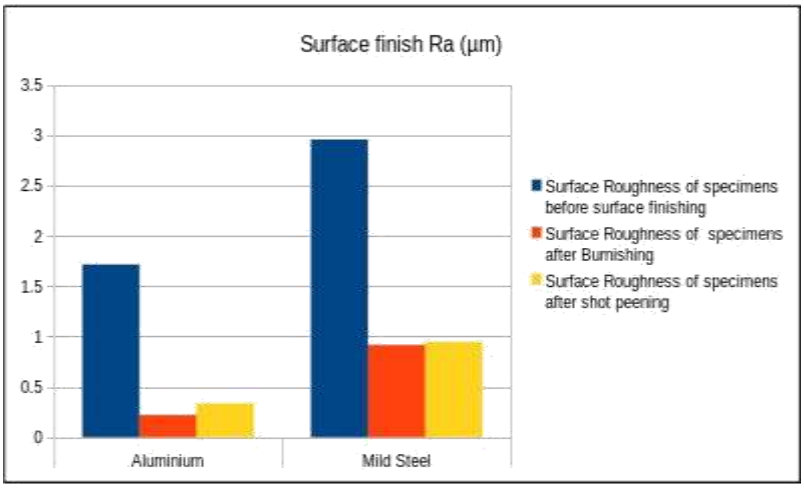

Fig. 6: Comparison of variation of surface roughness for mild steel specimens before and after shot peening.

CONCLUSIONS

Roller burnishing and shot peening surface finish process have been done on aluminium and mild steel specimens. The test specimens have been experimented with different process parameters to obtain good surface finish.

The roller burnishing tool has been used for surface finishing of test specimens. The number of tool passes has shown a drastic change on the surface finish. Aluminium, brass, copper and mild steel specimens has been used for the experimental work.

It is concluded that due to the roller burnishing process the surface finish of the test specimens was maximum at number of tool passes =3 with a burnishing force of 56.9N. The change in surface finish was maximum for aluminium test specimens it was 92% and for mild steel specimens it was 69%.

The aluminium test specimens had a maximum increase in surface finish due to its ductile nature and yield strength when compared with mild steel.

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